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THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 57 Thursday, July 1, 1937 No. 1089

PUBLISHED WEEKLY

Subscription Terms : 15s. per annum.
Foreign and Colonial : 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL
49, WELLINGTON STREET, LONDON, W.C.2

Telegraphic Address : "Zacatecas, Rand, London."
Telephone : Temple Bar 3951 (5 lines).

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF

The Institute of British Foundrymen

The Institute of Vitreous Enamellers

The Welsh Engineers' and Founders' Association

and

The Foundry Trades' Equipment and Supplies Association

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International Congresses

There is a marked tendency on the part of the International Foundrymen's Technical Committee to standardise the general programmes and procedure of the Congresses held under their auspices. We agree that on certain matters, such as the *modus operandi* of preparing and presenting Papers, it is worth while, but even in this case the venue of the Congress is a matter of some consequence. For instance, next year the Congress is to be held in Poland, and probably between eighty and ninety per cent. of the Papers will require to be translated, but the year after, when Great Britain is the host, this figure will probably be reduced to ten or fifteen per cent. Hence much more time must be accorded to Warsaw for translation and preparation, and, moreover, the facilities for dealing with Papers must vary in each country.

It is our opinion that, so far as the time factor is concerned, the best service can be done by having the Papers in the hands of the participants two weeks before the Congress in one of the four principal languages, together, if possible, with a short abstract in the other three. If the material disclosed is of real interest, then it is reasonably possible to have a translation made privately. Naturally, when countries speaking a secondary language organise a conference, they will require a separate translation of their own. The question of the standardisation of hospitality has been raised, but beyond the postulation of a minimum of details, this is best left to the hosts, who are obviously most familiar with the measure of their own purse. The charm of any international congress is invariably the expression of the national characteristics. The concert at the Zoological Gardens in Düsseldorf; receptions at the Town Hall in Brussels; at the Chateau d'Embourg, near Liège; by Signor Mussolini and His Holiness the Pope; the President of the French Republic, and equally charming manifestations in the United States, Spain and Czecho-Slovakia stand out in one's memory. On the Continent, there is generally a closing banquet, but in this country we prefer in general an informal dance or an excursion to be the concluding ceremony. We feel that the very last object to be sought is standardisation beyond the minimum necessary to ensure co-ordination and continuity.

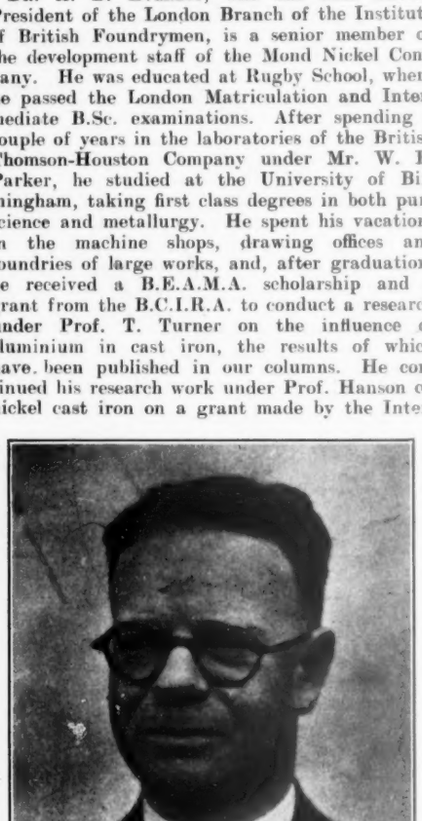
The Cupola

The ordinary foundry cupola represents one of the most difficult problems facing the foundry industry. It is so comparatively cheap, convenient and elastic as a melting unit that no other furnace really seems likely to become a serious rival to it, however useful alternatives may be for special purposes. It presents two paradoxes evident to the most superficial observer. It is capable of producing metal of comparatively high quality when run under proper control, and, secondly, it will produce metal of a kind from almost any design worked under the most deplorable conditions. It will stand more ill-treatment than any other furnace. There are scarcely any limits to the size, quality and quantity of the scrap, fuel and flux with which it will deal. The developments which have taken place in its construction since its origin would fill a book, yet comparatively few have established themselves permanently. Each development, however, makes a contribution to the ultimate working out of a comprehensive theory of cupola operation, as, indeed, do increases of scientific knowledge with respect to the effect of air, gases and inclusions on molten iron. Such theory depends ultimately on the combustion of carbon itself, a matter about which we know very little, and in the case of the cupola, a working theory is very difficult to evolve. To begin with, it must be based on what the metallurgist would describe as equilibrium conditions, which are rarely, if ever, reached in the cupola, partly because the materials concerned differ from point to point and partly because the time taken is too short to permit these conditions to be realised. Any founder of experience will know that a combination of design, charge material and operating conditions such as those concerning the air supply which might be expected to give certain results from previous experience often give quite different results. Conversely, similar results accrue from the widest possible variations in operating methods, design and layout. So practical experience plays a large part in settling matters which the expert of the future will be called upon to rationalise and lay bare to our better understanding.

District Presidents—No. 1

LONDON BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN

DR. A. B. EVEREST, who has been elected President of the London Branch of the Institute of British Foundrymen, is a senior member of the development staff of the Mond Nickel Company. He was educated at Rugby School, where he passed the London Matriculation and Intermediate B.Sc. examinations. After spending a couple of years in the laboratories of the British Thomson-Houston Company under Mr. W. B. Parker, he studied at the University of Birmingham, taking first class degrees in both pure science and metallurgy. He spent his vacations in the machine shops, drawing offices and foundries of large works, and, after graduation, he received a B.E.A.M.A. scholarship and a grant from the B.C.I.R.A. to conduct a research under Prof. T. Turner on the influence of aluminium in cast iron, the results of which have been published in our columns. He continued his research work under Prof. Hanson on nickel cast iron on a grant made by the International Nickel Company. His results are recorded in the proceedings of the Iron and Steel Institute and in our columns.



DR. A. B. EVEREST, PH.D.

In 1927, he joined the Institute of British Foundrymen, and was selected the following year to present a Paper to the international foundry conference held in Barcelona. By then he had joined the Bureau of Information on Nickel, which had recently been organised under the management of Mr. A. C. Sturney. In 1929, the nickel interests having been combined, Dr. Everest was transferred to the Research and Development Department of the Mond Nickel Company, Limited, under Mr. W. T. Griffiths, where he has been employed in servicing the iron foundry industry. He is now known internationally as a lecturer upon alloyed cast irons, and his work is to be found in the literature of the United States of America, France, Germany, Italy, Spain, Russia and Japan. Amongst other activities, he represents the Institute on the International Testing Committee, acts as secretary to the Cast Iron Sub-Committee of the Technical Committee, and participates in the work of the British Standards Institute. His principal hobby is gardening, whilst he is an expert photographer.

Random Shots

On a beautiful June evening a merry dinner was held at the National Liberal Club to honour the occasion of a knighthood having been conferred on Sir Paul Booth, and as a mark of esteem of the very valuable work he has done for the club as chairman of the Management Committee since 1931. The company was honoured with the presence of the Rt. Hon. Lord Meston, Sir John Simon, and Sir Archibald Sinclair, all of whom spoke in very high terms of Sir Paul's work. Sir John Simon had come straight from the House, where he had just been putting the final touches to a certain White Paper, which, in its original form, had caused quite a lot of growling amongst the industrial lions (the first scheme for the N.D.C. being N.B.G., so to speak). It was gratifying to see such splendid support from the foundry industry, which was represented by Mr. C. C. Booth, Mr. and Mrs. Bigg, Mr. D. H. Wood, Mr. G. E. France and Mr. and Mrs. Faulkner. Men very familiar with White Paper activities mingled with those more used to blue prints, and it must have been quite refreshing for them, having come straight from Derby, where everyone talked about casting or costing or high duty alloys, to dine amongst others to whom such things were a mystery. "What do you call your paper?" asked Mr. Faulkner's neighbour, "The Forged Hand?"

The presence of that little band of foundrymen must surely have conveyed to Sir Paul the esteem in which that industry holds him and that they share with his fellow-club-members the same pride in his recent honour.

* * *

That politicians are ever good at finding an expedient was illustrated by an amusing incident at the dinner. When Sir John Simon asked for the window to be shut because of the draught he was told that someone at another table had just asked for it to be opened. "Very well," said Sir John, "I'll put my hat on!"

* * *

The British party, so recently returned from "Gay Paree," seem to have had a very successful time, speaking technically, and a very entertaining time, speaking socially. They all but had to take off their jackets and go a-hammering in the Exhibition, but evidently decided that it would look bad after the Lord Mayor of London had so definitely and indubitably declared it open. However, to quote E. V. Lucas, who in turn quotes someone else writing of the "Egsposissiong" of 1867, "Jer swee sewer kil serar urn grong sooksay."

* * *

One of our brightest schoolboys translated "Il l'a suivi à la dérobée" as meaning "he followed her to the disrobing room," whilst the wag who knew that its real meaning was "to follow her stealthily" remarked that the two translations were synonymous—and got five hundred lines for being cheeky! It sounds as if the boys at this school know too much. Can it be that they hail from Narkover College?

* * *

"Bronze Wings for Sea Queen" is the heading given to an article in an American technical journal. Nothing short of a "Queen Mary" could inspire such imaginative journalism; but it sure provides a swell idea for a movement for "Brighter Technical Journalism."

* * *

"Some M.P.'s go hungry," reads a headline in a recent daily paper. Why do they not take a lead from the Japanese government by effecting a reform in their Diet?

* * *

"The red glow from blast furnaces was seen in the sky over Cleveland again during the night for the first time in a month," says a report from New York. Things beginning to look more rosy at last?

* * *

G. B. Shaw refuses to shave off his beard in spite of the inconvenience it would cause in the wearing of a gas mask. This is surely a very Un-Shavian decision!

"MARKSMAN."

SNAPPED AT DERBY

Top.—A Group of Past-Presidents of the I.B.F., including Mr. F. J. Cook, Mr. R. Stubbs, Mr. J. E. Hurst, Mr. H. Winterton, Mr. V. Stobie and Mr. C. E. Williams.

Below.—Mr. V. Jobson chatting with Mr. Roy Stubbs.

Inset.—The President, Mr. C. W. Bigg, with the oldest Past-President, Mr. F. J. Cook.

Below.—The Vice-Presidents, Mr. J. Hepworth, M.P., and Mr. W. B. Lake, J.P.

Bottom.—Mr. A. Sutcliffe still Championing the Importance of the Practical Man.

The International Foundry Congress in Paris

The International Foundry Conference was this year held in Paris, from June 17 to 24, Paris being chosen as the venue in order that members attending the Conference would also have the opportunity of attending the great International Exhibition which is now being held in that City. The Conference was of particular interest to members of the Institute of British Foundrymen, because Mr. Vincent Delport, a prominent member of the Institute, and an ex-President of the London Branch is this year President of the International Committee of Foundry Technical Associations in his capacity of European representative of the American Foundrymen's Association.

The arrangements for the Conference were made by the Association Technique de Fonderie, and it is a happy coincidence that the President of this Association, M. Achille Brizon, was a fellow student in the same year at the Ecole Centrale des Arts et Metiers in Paris, with Mr. Delport, who was the principal guest at most of the functions.

The Conference was attended by about 650 members and ladies representing 17 countries. The British party numbered 45 members and ladies, the majority of whom travelled in a group leaving Victoria Station, London, at 9 a.m. on Thursday, June 17. The group included Mr. C. W. Bigg, President of the Institute, Mr. Victor Stobie, Past-President, and Mr. J. G. Pearce. The arrangements for the travel and hotel accommodation were made by the Secretary, Mr. T. Makemson, in conjunction with Thomas Cook & Sons.

The whole of the meetings were held at the Club of the Old Students of the Ecole des Arts et Metiers, and it was in this building that the opening reception took place on the evening of June 17, a gathering which afforded an excellent opportunity to renew old friendships, and to make new ones.

Opening Ceremony

The official opening meeting of the Conference was held on the morning of Friday, June 18, under the presidency of M. J. Julien, Under-Secretary of State for Technical Education. M. A. Brizon, President of the Association Technique de Fonderie, welcomed the visitors, and expressed his gratitude to the various distinguished public men and industrialists in France who had contributed to the organisation of the Congress. He then proceeded to deliver a presidential address, which was a masterly review of the progress of modern foundry practice in all branches of the industry, dealing particularly with the progress in the founding of aluminium and other light alloys, which is Monsieur Brizon's own speciality.

Mr. V. Delport, President of the International Committee of Foundry Technical Associations, then spoke on behalf of the whole of the visitors from other countries, and expressed the thanks of the visitors to their hosts. M. M. Oliver, President of the Syndicat Generale des Fondeurs de France, spoke on behalf of the foundry owners of France, and gave an interesting account of the manner in which the foundry owners and directors endeavoured to link up with the Foundry Technical Association. The final opening speech was made by M. Julien, who spoke on behalf of the Government.

At the conclusion of the opening formalities, M. H. Luc, Director-General of Technical Education, delivered a lecture on "Technical Education and the Foundry in France." M. Luc reviewed the efforts which were being made to promote technical education suitable to those persons entering or already engaged in the foundry industry, and made a strong plea for the inauguration of a complete system of apprenticeship. At the conclusion of the opening meeting, all of the members and ladies partook of luncheon at the Luxembourg Pavilion at the International Exhibition, and M. Brizon presided. Short addresses were made by M. Luc and Mr. Delport.

In the afternoon the whole party visited the Palace of Discoveries at the International Exhibition under the direction of M. Urbain. This section of the Exhibition is held in the Grande Palais, and is a very wonderful display of modern scientific apparatus and of models and experiments illustrating scientific principles. It is organised and laid out with considerable imagination, and in itself forms a scientific exhibition of very high order.

Technical Sessions

Saturday, June 19, was devoted to the presentation and discussion of Papers. Members and ladies met together for luncheon at midday, and in the afternoon ladies were taken on a conducted tour of Paris. In the evening there was a dance organised by the Association of Old Students of the Foundry High School.

No arrangements were made for Sunday, June 20, and most of the party devoted the whole of the day to those portions of the Exhibition which were then ready.

The meeting of the Congress on Monday morning was of particular interest to British and American delegates, as it was at this meeting that the official Exchange Papers of the Institute of British Foundrymen and the American Foundrymen's Association were presented, and Mr. C. W. Bigg, President of the Institute of British Foundrymen, was one of the joint Presidents of the meeting. The British Paper, by Mr. H. H. Shepherd, on "Malleable Iron Melting Practice—Retrospective and Prospective," was briefly introduced by the author, and a summary in the French language was then presented on his behalf by Mr. Delport. Mr. Delport also presented a summary of the American Exchange Paper on "Irons for Industrial Vehicles," by Mr. P. Eddy. In addition, the Spanish and German Exchange Papers were also presented at this meeting.

During the afternoon ladies were taken to the Garden City of Surennes, and visited the Open Air School, and at 5 p.m. members and ladies were received at the Paris Chamber of Commerce. They appreciated the opportunity of inspecting the saloons and gardens of this very fine building.

Social and Educational Visits

A very interesting visit was that which took place on Tuesday morning, June 22, when all of the members of the Congress inspected the laboratories of the magnificent Ecole Centrale, the alma mater of M. Brizon, President of the Association Technique de Fonderie, and of Mr. Delport, President of the International Committee of the Foundry Technical Associations. The party was received and personally conducted round the building by M. Guillet, the Director of the School, who is himself a very distinguished metallurgist.

A respite from the work of the Congress was given in the afternoon, when the members and ladies travelled by motor coach to Malmaison, the residence of Napoleon and Josephine. The party was received at the entrance to the grounds by M. J. Bourguignon, the curator of the Chateau, and were conducted through the Chateau and gardens. The party then proceeded to St. Germain, where they had tea at the Henry IV Pavilion, which commands a magnificent view of the valley of the Seine.

An unusual visit took place on the evening of the same day, when the whole party visited the Louvre, and were conducted through the Greek and Egyptian departments. A wonderful lighting system has recently been installed in the Louvre, and the method of spot lighting the various statues and other works of art is carried out in an extraordinarily clever manner.

On Wednesday morning members visited the Foundry High School, which is now well known throughout the world as one of the principal centres for training foundry executives, and were received and conducted through the School by Professor Albert Portevin, the Director. Later in the morning a reception was held at the Hotel de Ville by the Municipal Council of Paris.

Further Papers were discussed during the afternoon, and the ladies visited the Chateau de Bagatelle and its famous rose gardens, where a mannequin parade was held.

Closing Ceremony

On the closing day of the Conference, Thursday, June 24, members visited the famous locomotive testing works at Vitry sur Seine. The closing meeting of the Congress was held in the afternoon, when Professor Pisek, President of the Foundry Technical Association of Czechoslovakia, lectured on the "International Importance of Industrial Research." Later, M. Julien, Under-Secretary of Technical Education in the late Government, took the chair, and the Conference was formally closed by M. Brizon. Short addresses were also given by M. Julien and Mr. Delport.

An interesting ceremony took place at this meeting, when bronze plaques were presented to various authors of Papers, including Dr. Paul Bastion, who was joint author of a Paper given to the Glasgow Conference. A plaque was also presented to M. J. Léonard, President of the Belgian Foundrymen's Association, and ex-President of the International Committee, as an acknowledgement of his services to the foundry industry and particularly for his work in promoting international co-operation.

On behalf of the Foundry Technical Association of Czechoslovakia, Professor Pisek then presented to the Association Technique de Fonderie de France, a bronze statuette with a replica of the coat of arms of the Czechoslovakian Association.

The final function of the Conference was the closing banquet, which was held at the Pavilion Dauphine, at the entrance to the Bois de Bologne. M. Luc, Director-General of Technical Education, presided, and was supported by M. Brizon and Mr. Delport. This banquet was attended by most of the prominent personalities in European foundry practice, the Institute of British Foundrymen being represented at the high table by Mr. C. W. Bigg, its President.

International Committees.

The annual International Conference has usually afforded an opportunity for the meetings of various International Foundry Committees. The International Committee on Testing Cast Iron held its meeting on Saturday, June 19, under the presidency of Monsieur Léonard, of Liége, the acting President; Professor Portevin, the Honorary President, was also present at the meeting. The British representatives were Mr. J. G. Pearce, Dr. A. B. Everest, and Mr. T. Makemson.

On Wednesday, June 23, members of the International Committee of Foundry Technical Associations were entertained to luncheon by the President, Mr. V. Delport, and later the members of the Committee attended at the Arc de Triomphe, where Mr. Delport and M. Brizon, on behalf of the Committee, laid a wreath on the tomb of the Unknown Soldier.

Later in the afternoon a meeting of the International Dictionary Commission took place, under the presidency of Monsieur J. M. Espana, Mr. Makemson being present as the representative of the Institute of British Foundrymen, and later in the day the annual meeting of the

International Committee of Foundry Technical Associations was held, Mr. V. Delport presiding. The British representatives at this committee meeting were Mr. C. W. Bigg, Mr. V. C. Faulkner, and Mr. T. Makemson, who was present as Secretary.

The Committee devoted a considerable amount of time to certain regulations of administration governing future International Congresses, and then proceeded to the election of officers for the year 1938. The German Association—the Technischer Hauptausschuss für Giessereiwesen—accepted the invitation to nominate the President for the year 1938, and an invitation was issued to the Italian foundrymen to nominate the Vice-President for the same year with a view to his becoming President in the year 1939. On behalf of the Italian Foundry Association, Dr. Guido Vanzetti accepted this invitation.

The meeting concluded with a vote of thanks to the Association Technique de Fonderie for the arrangements they had made for the accommodation of the meeting.

The Papers presented to the Congress included Exchange Papers from a large number of foreign countries, in addition to a number of Papers by French authors; altogether 46 Papers were presented at five technical sessions, each of which was held in duplicate. In addition to the official Exchange Paper from the Institute of British Foundrymen by Mr. Shepherd, Dr. A. B. Everest presented a Paper on "Ni-Resist Iron in Great Britain," and Mr. G. T. Lunt was the author of a Paper on "The Industrial Production of High Quality Irons." These Papers were presented at the session on Wednesday afternoon, June 23, Dr. Everest presenting his Paper in person.

The International Exhibition is conceived on a grand scale, and when finished will cover almost every branch of human endeavour. Each pavilion is devoted to a different section, such as art, science, fabrics, etc., in addition a large number of nations each have an individual pavilion devoted to the products of its own country. Unfortunately owing to labour troubles and other difficulties, the Exhibition is in a very unfinished state, and it will be some weeks before all the pavilions are open.

The Palace of Discoveries in itself is worth a visit to Paris, and many of the national pavilions which are finished give a magnificent review of the industries of the nations which they respectively represent.

The British Pavilion was opened by the Lord Mayor of London during the period of the Congress. The Lord Mayor and his party, including a retinue of liveried servants, travelled to Paris on the same train as the British foundry party, the members of which were enabled to get a "front seat" view of the official reception of the Lord Mayor at the Gare du Nord.

The President and Officials of the Association Technique de Fonderie are to be congratulated upon having organised so large and successful a Congress in the face of very considerable difficulties. It was impossible, owing to labour difficulties, to announce the list of foundry visits more than a week or two in advance of the Congress, and in order that members should have interesting industrial visits, the inspections of the locomotive testing works, the Ecole Centrale, and the Ecole Superieure had been arranged. Visits to important foundries, however, were arranged, though naturally they overlapped to some extent with other items in the programme. Everything had been done to make the Congress as interesting and useful as possible to overseas visitors, and the thanks of all the visitors are due to their French hosts for that which they achieved in the face of very considerable obstacles.

Finally acknowledgment must be made to the President of the Association Technique de

(*Concluded in next column.*)

Institute of British Foundrymen

DELEGATES AT DERBY CONFERENCE

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(*Concluded from previous column.*)

Fonderie, M. Brizon; to its General Secretary, M. Meyer; to the Committee and the officials of the Association, and to the large number of members and ladies who contributed to the success of the Congress, and who received their foreign visitors so hospitably. The personal efforts, the friendliness, and hospitality of these ladies and gentlemen contributed in no small measure to a very happy gathering.

Duty-Free Imports of Ferro-Silicon

The Treasury, on the recommendation of the Import Duties Advisory Committee, has made the Import Duties (Exemptions) (No. 9) Order, 1937, which provides for the addition to the free list as from June 24, 1937, of ferro-silicon containing not less than 20 per cent. of silicon.

Ferro-silicon containing not less than 35 per cent. of silicon is already exempt from duty under Section 14 of the Finance Act, 1933. There is, however, no manufacture in this country of ferro-silicon containing 20 per cent. or more of silicon, and the Committee considers that it will be of some assistance to the iron and steel industry if the existing duty is removed from the lower grades. At the same time it considers that with a view to avoiding undue complication of the free list the higher grades of ferro-silicon should also be added to the first schedule to the Import Duties Act.

BROOM & WADE, LIMITED, of High Wycombe, manufacturers of air compressors, pneumatic tools and rock drills, etc., called an extraordinary general meeting on June 28 to consider a resolution to increase the capital of the company to £290,000 by the creation of 100,000 new ordinary shares of 5s. each. The resolution was passed.

The Production of Ingot-Mould Castings

By R. BALLANTINE

(*Continued from page 532, Vol. 56.*)

Gating

Investigations on proper gating have revealed many things in the past. What may be accepted practice in certain foundries operating on specialised work may be the very opposite practice in equally efficient foundries engaged on similar work. As stated previously, drop-gates, either of the pencil type or rectangular section, have been eliminated, as much cleaner tops are secured by the down-gate and in-gate arrangements. While Fig. 7 is elementary it shows

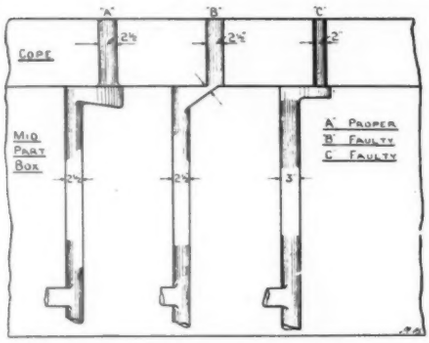

FIG. 7.—DOWN-GATES THROUGH COPE AND MID PART.

three down-gates encountered. Type A, which is considered proper, is the type in use. The diameter varies in size, and numbers depend on the casting's weight. Type B is unsatisfactory, but it is amazing how often one sees this type in practice. The flow of metal is governed by the aperture at the cope and mid parting. A time-record of pouring reveals the extended pouring time for filling the ingot mould casting. If the pouring time be unduly prolonged, the sluggish hematite iron churns against the core

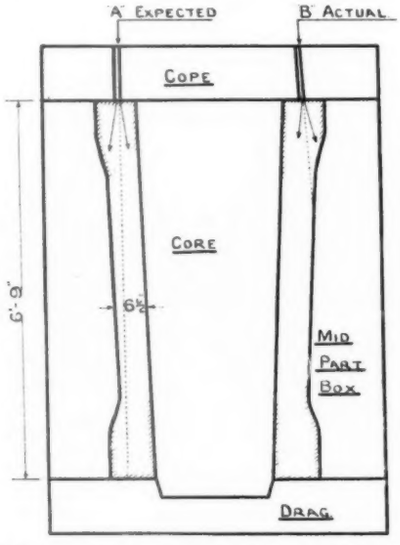

FIG. 8.—PENCIL GATES ON INVERTED MOULD.

and mid part walls creating skin defects. An equally bad arrangement is shown at C, and is more commonly used than is credited. The down-gate through the cope determines the pouring rate irrespective of the larger diameter down-gate in the mid part.

Fig. 8 indicates the method for top pouring an inverted mould by pencil or rectangular gates. The gate on the left will spread despite the accuracy of vertical setting, but the one on the right shows what actually occurs in practice. Either an acute angle leading outwards or inwards is obtained. Metal entering the mould impinges either on the core or mid part in its downward travel. This is most objectionable, and, moreover, pellets are formed and never appear to be re-absorbed despite the heavy body of metal in the wall thickness.

In-gates are all rectangular. The total cross sectional area of in-gates is equal to the down-gate cross sectional area directly feeding the in-gates. It is good practice to keep the lower in-gate slightly larger than the upper if two be used from the one down-gate. If no attempt be made to regulate the ratio of in-gate to down-gate, and the former is in excess of the latter, a trickling of metal from the higher gate tends to cause surface blemish in the casting.

The plan view in Fig. 9 is that of an octagonal mould in the mid part box, and alternative methods of gating are shown. The right-hand half gives the impression of gates running against each other, and to a certain extent they do, but the stepped effect for two ladle pouring shown in Fig. 10 demonstrates that disturbance is not severe. Further, if the core be turned and set according to the dotted line in Fig. 9, the fluted part becomes parallel to the in-gate entry, consequently limiting the tendency to disturb the core projections.

Alternatively, the left hand plan, which shows in-gates following each other, would appear in theory to be much more satisfactory for producing fluted octagonal or duodecagonal mould castings. The author does not, however, favour the whirling action of metal entering the mould, especially for cores made in dry sand. There are eight and twelve points of attack in cores of this type. Whirling metal is particularly severe; blackwash scales rapidly and fusion of the sand and casting occurs. If the moulds were cylindrical, this system would be adopted exclusively.

Flaking or Corner Scaling

A disturbing factor in many ingot mould foundries is the flaking or scaling at corners, and many explanations are put forward why this should occur so frequently. There is a feeling in some quarters that the problem is a metallurgical one, and the practical investigator rarely attributes this problem to wrong foundry practice. The author disagrees with both opinions. In Fig. 11 is a cross section of a 10-ton mould and core. The section is square and the ash centre is shown in position. Difficulties are rarely encountered due to flaking of corners on any of the moulds manufactured, but the problem has arisen. It has been frequently asked why this should happen when the same metal has been used, a correct pouring temperature established, and no change made in the system of manufacture. The construction of

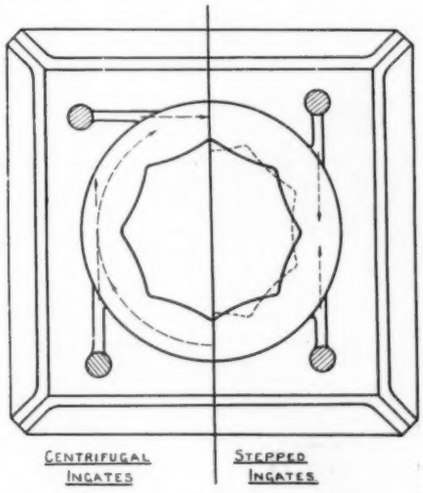

FIG. 9.—TWO METHODS OF GATING.

the core is of vital importance in overcoming this trouble. Fig. 11 reveals a large sand area at A as compared with the amount at B. Added to this, the corners are definitely harder at the fillets.

In view of this, three factors should be borne in mind:—

1. If the body of corner sand be large, thereby increasing the length of travel to the vent of gases evolved, trouble arises.

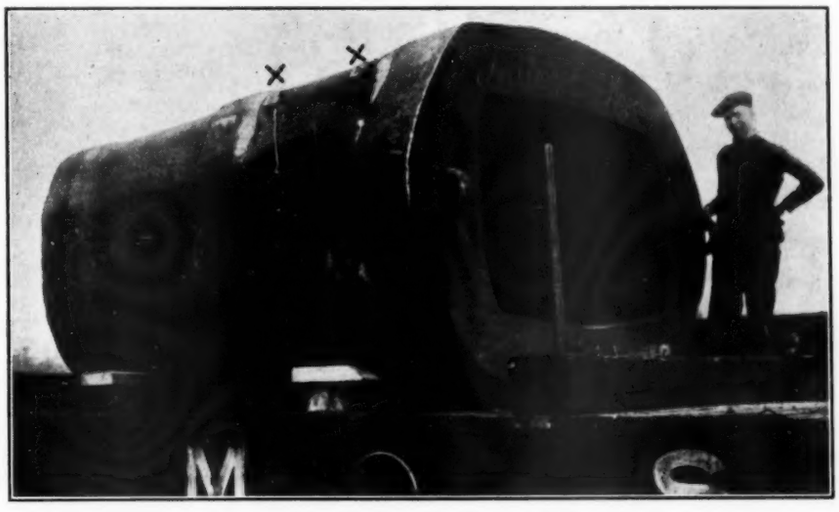

FIG. 10.—A 34-TON INGOT-MOULD CASTING.

2. If the sand skin at corners be trowelled extensively, and glazed before blackwashing, the trouble is aggravated.

3. If sand be used which is more suitable for the manufacture of ornamental castings, then flaking or scaling cannot be avoided.

The rare occasions on which this scaling has appeared have been effectively dealt with by limiting the sand area and by having good venting properties in the core sand used. A large grained sand, with a minimum bond, giving high permeability, should be used. The addition of

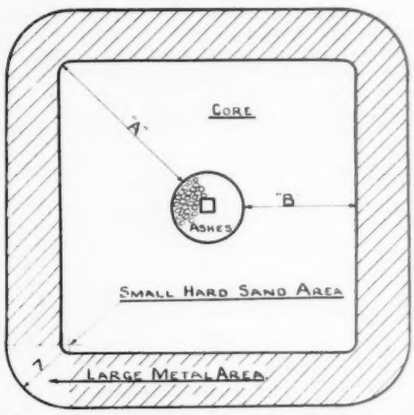

FIG. 11.—FACTORS INFLUENCING FLAKING OR CORNER SCALING.

FIG. 12.—ANOTHER VIEW OF THE 34-TON INVERTED MOULD CASTING SHOWN IN FIG. 10.

FIG. 13.—INVERTED MOULD CORE FOR A 34-TON CASTING.

gas-forming materials, such as coal dust, sawdust, etc., is unnecessary. The removal of fines is essential in reconditioned sand and a liberal coating of blackwash as a facing is recommended.

A 34-Ton Inverted Mould Casting

The end view of a 34-ton inverted mould casting shown in Fig. 12 gives a true indication of the core outline, and the very uniform metal thicknesses throughout the casting. Whilst the compensating metal surrounding the lifting handle looks "massive," it is nevertheless uniform. The effect of handle insertion tends to densen the heavy snug part. A pocket core

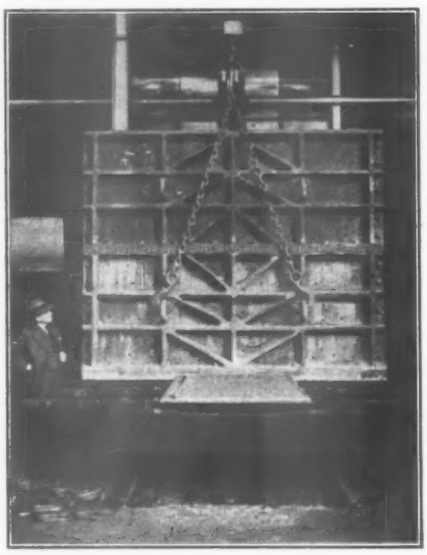

FIG. 14.—TYPE OF MOULDING BOX USED FOR A 34-TON INVERTED MOULD CASTING.

underneath further assists by ensuring uniform cooling.

The angled view showing top and side, as in Fig. 10, clearly demonstrates the minimum fin allowance on the outside of the casting, and the trimmed inside is free from any kish or cold-shut markings. Four in-gates can be seen and these are fed by a second ladle. These, and another six, however, are arranged for two ladle pouring. On the other side of the casting, six in-gates

FIG. 15.—MID-PART AND CORE FOR A 34-TON INVERTED MOULD ENTERING STOVE.

are placed, four below the middle belt and two above. Pouring is timed so that the ladles finish together. Six risers are placed on the broad-sides, *i.e.*, three on each side, and the riser basins are so arranged that draining of the pouring heads is assured. Pouring time for this particular casting is 4½ minutes and the second ladle commences pouring two minutes after the first. The influx of fresh metal livens considerably the sluggish tops formed from the first ladle. Feeding is never practised even on castings such as these.

The core shown in Fig. 13 is the one used in manufacture, and weighs approximately 5 tons in the green state. Six rectangular grids of very light section are used and are placed horizontally; and no iron uprights are included. The whole structure which is shown before entering the stove is carried on the core plate. Apart from the venting properties of the ash centre, the lifting rods are accommodated and can move freely and respond to any undue strain set up in the transit of this core. The mid-part as shown in Fig. 14 is an all-machined box for producing these castings. Cross membering of the broad sides is advantageous, as any tendency to splitting while in service is definitely curtailed by the varied-angled webs shown.

In Fig. 15 is the complete mid-part and core. Just inside the stove are the semi-permanent cope and drag. Lives obtained from inverted type moulds give a much smaller average than those obtained from common moulds, and this is only to be expected when types are compared. Some of these 34-ton inverted castings give lives as high as 57 heats.

(To be concluded.)

The International Foundrymens' Technical Committee

During the International Foundry Congress, held in Paris last week, a meeting of the International Foundrymen's Technical Committee was held under the presidency of Mr. V. Delport. The members were the guests of Mr. Delport for luncheon, and afterwards a wreath was laid on the grave of the *Soldat Inconnu* at the Arc de Triomphe. The main discussions centred around the creation of an international foundry dictionary, the *modus operandi* for the preparation and presentation of Papers to International Congresses, and the question of hospitality. The new President of the Committee is to be nominated by the German authorities, and an announcement can be expected in the near future. As Vice-President Dr. Guido Vanzetti was nominated, but he too requires a few days to think it over before acceptation. If he accepts, as everybody hopes he will, he will be the principal delegate at the Congress to be organised by the Institute of British Foundrymen in 1939.

In inviting the members of the various associations represented to participate in next year's Warsaw Congress, Professor Gierdziejewski said that during the meeting of the Committee held at Prague in 1933, Poland was chosen as hosts for the foundrymen in 1938. Time had passed quickly, and the next meeting will be held at Warsaw. The now independent Polish Foundrymen's Association is known from its initial letters at S.T.O.P., which in polish means an alloy. It has now more than 200 members, so that it will be an onerous task to arrange a conference. The comparatively small industrialisation of Poland means that its research work is restricted, but no doubt it will be appreciated; and any defects will be more than made up for by the heartiness of the welcome delegates will receive. The opening session will be held on September 8, 1938, and a large attendance of foundrymen from all over the world is confidently expected.

A FIRM OF MERCHANT BANKERS has provided further working capital for Kitson & Company, Limited, locomotive engineers, of Leeds, and acquired a controlling interest. The receivership has been brought to an end, and the company is now provided with adequate resources to carry on its business.

Notes on the Structure and Characteristics of Aluminium Alloys

By H. C. HALL, M.Met., F.I.C.

(*Concluded from page 525, Vol. 56.*)

Heat-Treatment

Heat-treatment does not result in serious volume dimensional change so long as precaution is taken to avoid distortion at the moment of actual quenching from the "solution" temperature. On the other hand, heat conductivity is considerably reduced by it as compared with the alloy in the "as cast" or "annealed" condition. This may be important when considering piston and cylinder-head castings for high power internal combustion engines.

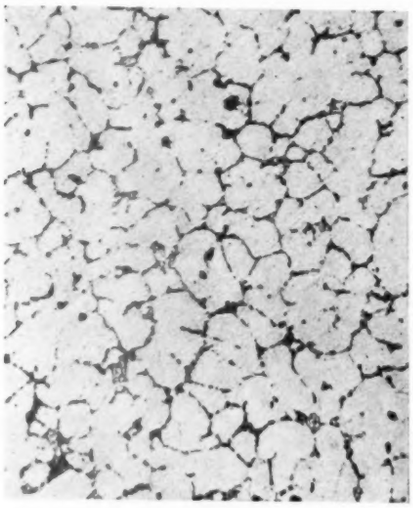

FIG. 12.—STRUCTURE OF R.R.50 ALLOY, SAND CAST FROM 710 DEG. C. × 100.

Quenching a large casting which has considerable local variation in section results in local internal stress. Subsequent normal ageing treatment does not tend to reduce this, and may even aggravate it, owing to the simultaneous increase in hardness which occurs. Such stress may approach the elastic limit of the material and cause the casting to fail under relatively light loading in service. A semi-anneal treatment with some consequent sacrifice in Brinell hardness and elastic limit, may be beneficial in such a case.

Castings are often given an ageing or precipitating treatment only at about 150 deg. C., primarily to prevent future distortion. Some increase in hardness and reduction in ductility is noted as a rule. This is more marked with chill-cast alloys in which more $CuAl_2$ and Mg_2Si, etc., are retained in solid solution owing to relatively rapid cooling in the mould; this is equivalent to a mild solution treatment. After about 6 hrs. at 150 to 170 deg. C. internal stresses due to casting contraction are generally eliminated completely if the material is not solution treated. The alloy RR50 is treated in this way since the gain in strength, obtained by the duplex treatment, is not sufficient to warrant the added cost. With higher Mg_2Si, however, as present in RR.53C, or extra copper, a considerable increase in ultimate stress results. Both treatments improve machinability.

Table II shows a comparison between RR50, RR.53C and RR53 fully heat-treated and also precipitation treated.

These alloys, like those of the rest of the series, are characterised by fineness of grain, partly owing to carefully-balanced composition and partly due to the presence of titanium, which is now generally acknowledged to have a great refining effect. The structure of RR50 and RR53 alloys is given in Figs. 12 and 13 respectively. Their utility is particularly in the field of heavily-stressed engine parts. Both were sand-cast from 710 deg. C. and given low temperature heat-treatment only.

Fig. 14 shows the section of a water-cooled aero-engine cylinder, the temperature obtained during actual service being indicated. The piston may be made of RR.53 or RR.53C alloy, which are somewhat more resistant to heat than RR.50, but more difficult to cast. Y alloy is even more difficult to handle, particularly for the production of sand castings. Fig. 15 shows the tensile strength curves for RR.50, RR.53 and Y alloy compared with several other alloys up to 350 deg. C. The Y-alloy test is made on forged heat-treated alloy RR53 chill cast and heat-treated.

If the hot tensile test result and the limiting creep strength of a casting alloy be both relatively good at the temperatures prevalent in more highly stressed regions in the engine, it may be concluded that service will be satisfactory if other conditions are normal.

Aluminium containing 8 to 12 per cent. copper is liable to be too ductile at about 300 deg. C. If other constituents such as manganese, magnesium or silicon are added, particularly when used for sand castings, in an attempt to correct this fault, the characteristic brittleness of these alloys in the cold is further increased, or heat conductivity may be seriously reduced, as is the case with manganese addition. For instance, a 10 per cent. copper and 90 per cent. aluminium alloy has a value of 43 per cent. that of copper, and if 1 per cent. manganese be added, it is then only about 30 per cent. (in the range 0 to 300 deg. C.).

TABLE II.—*Compositions and Mechanical Strength (Tensile and Hardness).*

	Cu.	Ni.	Mg.	Fe.	Si.	Ti.
R.R.50	1.3	1.1	0.12	1.1	2.30	0.18
R.R.53C	1.2	1.3	0.50		2.50	0.16
R.R.53	2.1	1.3	1.50		1.0	0.07

	Low temperature heat-treatment (160 deg. C. for 8 hrs.).				High temperature duplex treatment (520 deg. solution treatment then 160 deg. C. for 8 hrs.).			
	Proof stress	M.S.	E. per cent.	Br. H.	Proof stress	M.S.	E. per cent.	Br. H
R.R.50 sand cast	9.0	12	3.0	70	13	17	2.5	90
R.R.53C sand cast	9.5	14	2.0	77	19	21	2.0	103
R.R.53 chill cast	12.5	17	1.0	96	21	22.5	1.0	140

High-Magnesium Alloys

High-magnesium alloys are also very sensitive to other additions, and are not sufficiently resistant to heat for most engine parts. This may be partly due to their liability to oxide flaws and skin blemishes, owing to their reactive tendency either with the oxygen in the air or during casting, particularly in the mould. Even the sand of a dry mould may contain combined moisture, which causes skin oxidation if the alloy contains over 0.2 per cent. magnesium with consequent liability to folds and leaky castings.

Fig. 16 shows a surface fold, whilst Fig. 17 shows an associated crack passing through the eutectic particles. Surface treatment of the sand mould to reduce reactivity of the internal face, as employed in the production of magnesium base castings, should be further investigated.

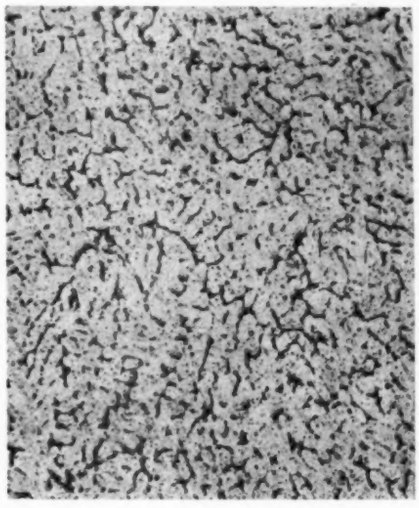

FIG. 13.—STRUCTURE OF R.R.53 ALLOY, SAND CAST FROM 710 DEG. C. × 100.

Cast alloys containing about 4 per cent. magnesium, together with relatively small additions of other metals for refining or hardening purposes, though much superior in the forged condition to other forging alloys, are not so in the sand-cast condition, when considering original and final physical properties after exposure to air, water, or saline spray. For instance, under boiling-water conditions as a water-cooled cylinder casting, RR50 shows better to advantage than a 4 per cent. magnesium alloy. High-zinc

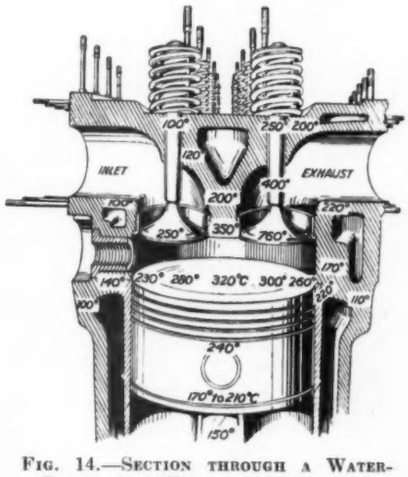

FIG. 14.—SECTION THROUGH A WATER-COOLED AERO-ENGINE CYLINDER SHOWING THE WORKING TEMPERATURE AT VARIOUS POINTS.

alloys such as 2L5 are liable to surface disintegration, even in the air, due to electrolytic action; similarly, the copper eutectic in high-copper alloys results in rapid surface corrosion, particularly in the presence of moisture.

High-Zinc Alloys

High-zinc alloys are too susceptible to heat for use if the temperature in service exceeds about 90 deg. C. owing to their tendency to soften with moderate heat. This softening persists on cooling, but after a time a type of ageing at ordinary atmospheric temperature results in the Brinell hardness rising from about 57 to as

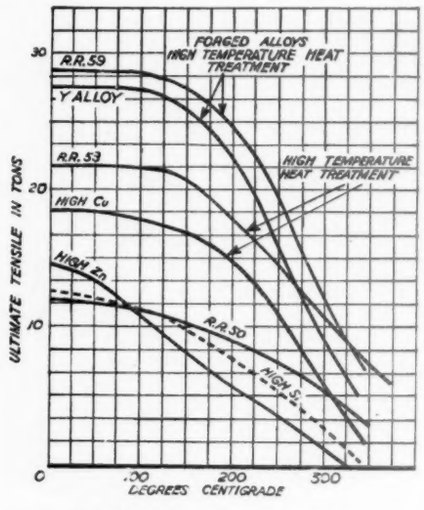

FIG. 15.—TENSILE STRENGTH CURVES FOR R.R.50, R.R.53 and Y ALLOY AND OTHER ALLOYS COMPARED.

much as 100 (Fig. 18). It appears that this cycle of change which takes place each time the engine is run and cooled again often results in local cracking after comparatively short service. With time, the ductility is almost completely lost, even if the part is in store.

Nickel, when alloyed with aluminium, is more finely dispersed than other metals of high melting point. Iron comes next in order, and these two metals form with silicon and aluminium complex eutectics which are not liable to coarse segregation if not more than about 1.5 per cent. of either is present; the same holds good if their total does not exceed about 2.5 per cent.

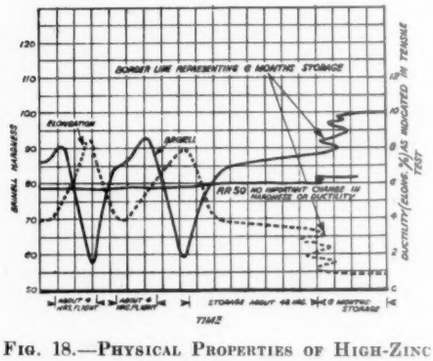
BORDER LINE REPRESENTING 6 MONTHS STORAGE
ELONGATION
BRINELL
RR 50 NO IMPORTANT CHANGE IN HARDNESS OR DUCTILITY
BRINELL HARDNESS
DUCTILITY (ELONG. %) AS ROOTED IN TENSILE TEST
TIME

FIG. 18.—PHYSICAL PROPERTIES OF HIGH-ZINC ALLOYS.

Fig. 19 shows, on the right hand side, a chill cast alloy containing 1.5 per cent. nickel (with iron about 0.3 per cent.). Nickel also associates well with copper in aluminium alloys, a triple eutectic being produced. The nature of this alloy, containing 1.4 per cent. nickel, 2.4 per cent. copper and 0.3 per cent. iron, is shown on the left hand side of Fig. 19.

Other heavy metals of high melting temperature should only be present to a small extent since they tend to result in segregation. Consequently uniformity of melt composition is difficult with more than about 0.3 per cent. total of chromium, vanadium, molybdenum and tungsten, etc. Manganese, owing to its greater solubility, may be used in quantity, but it is liable to result in brittleness. In casting alloys castability and fluidity are of vital importance. For this purpose the three testing outfits shown in Fig. 20 are useful.

The castability test is made up of two rigid steel bars, between and around the ends of which a particular alloy is cast under standard conditions. The longer the bar can be

FIG. 16.—SURFACE FOLD IN A HIGH MAGNESIUM ALLOY. × 10.

cast without cracking the less liable is that alloy to give trouble in the foundry. With 4 per cent. copper alloy 6 in. can be cast, with 12 per cent. copper, 10 in., with 12 per cent. zinc, 11 in., with 12 per cent. silicon, 16 in. and with RR50 14 in. Casting is generally carried out at about 680 deg. C. This temperature is also used when testing for fluidity. Table III gives the length or volume obtainable with various alloys. The volume method is more easily

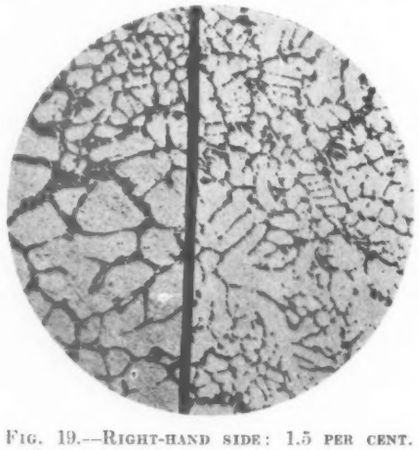

FIG. 19.—RIGHT-HAND SIDE: 1.5 PER CENT. NICKEL ALUMINIUM ALLOY. LEFT-HAND SIDE: ALUMINIUM ALLOY CONTAINING 1.4 PER CENT. NICKEL, 2.4 PER CENT. COPPER. × 150.

carried out. The reason that various alloys give such different results in tests is not fully understood. To obtain a good result with the castability test, the alloy generally requires to have a low contraction during solidification. Other factors which affect the result are its strength and ductility just after solidification, and the relative solidification range. Table IV gives the solidification ranges of various alloys and the volume contraction at the moment of solidification from the completely liquid to the completely solid state.

The separation of compounds or eutectics just after solidification by rapid diffusion is often associated with temporary "hot shortness" and this may cause cracks if the core stresses in the mould are considerable.

High Silicon Alloys

In high-silicon alloys, approximating to the eutectic composition, cavities are often

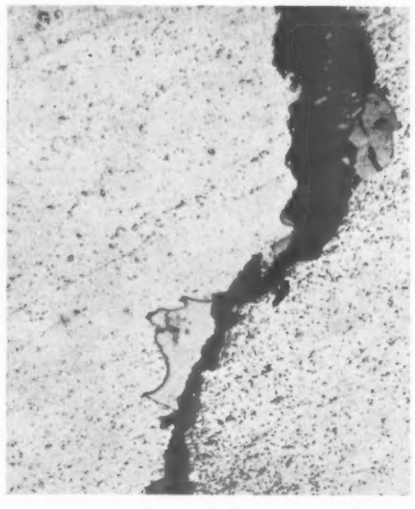

FIG. 17.—A CRACK ASSOCIATED WITH A SURFACE FOLD PASSING THROUGH EUTECTIC PARTICLES. × 500.

found at large changes of section, due in part to their very small solidification range. It also appears that there is a critical percentage of silicon between 0.5 and 1.8 per cent., which tends to result in cracked castings, owing to the existence of sufficient eutectic (melting point 570 deg. C.) to cause intercellular weakness just after solidification, but insufficient to result in liquid communication with runners or risers. Feeding is thus inade-

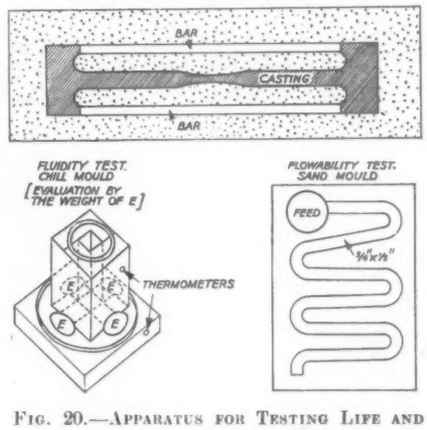

FIG. 20.—APPARATUS FOR TESTING LIFE AND FLUIDITY OF ALUMINIUM ALLOYS.

quate. The addition of nickel, however, and small amounts of other metals have a corrective effect even in the range indicated.

A small reduction in coefficient of expansion is realised by raising the silicon content from 2 to 12 per cent., *i.e.*, from about 0.000023 to 0.000021 (range 0 to 200 deg. C.). Much has been made of this; it must be borne in mind, however, that a 12 per cent. silicon alloy is too

soft for even moderately stressed parts even under relatively cold service conditions. If it be stiffened up by small amounts of copper, magnesium, manganese, etc., it is liable to be deficient in ductility, particularly if given a high temperature heat-treatment. As heat-resisting alloys these compositions are restricted in their application, owing to their relative weakness above 250 deg. C.; further, their heat conductivity is much lower than more heat-resisting alloys containing 1 to 2 per cent. silicon. These conclusions have been confirmed by performance when used for pistons, etc.

Flowability is not quite the same as "viscosity," since surface tension and the relative tendency to form oxide skin are both particularly important when casting into a sand mould.

Elements producing stable solid solutions tend to decrease fluidity. If present beyond the limit of true solubility, they then appear to produce a kind of emulsion which may or may not increase fluidity. Substances that produce precipitated compounds disseminated in the liquid generally increase fluidity; if present in considerable quantity they tend to make the alloy noticeably sluggish. This may be corrected in some cases, however, by increasing the temperature, when floating crystallites may be converted into more rounded forms or be partly dissolved; or, again, they may become completely liquid and have no important frictional influence. This subject is, however, very complex and controversial.

Fig. 21 shows aluminium containing a manganese aluminium compound in rounded form produced by rapid cooling from a relatively high temperature, and Fig. 22 shows the crystalline form as the result of slow cooling. Two per cent. manganese and traces of copper and titanium, etc., are present in each case. A similar difference is observed if the liquid alloy is agitated before casting instead of being heated to a high temperature.

Fluidity is much influenced by the presence of suspended oxide. Pure aluminium is not liable to contain it. In alloys, such oxide is often associated with the occluded gas bubbles in regions high in dissolved hydrogen, carbides of hydrogen, and carbon monoxide, owing to contamination by furnace gases or moisture. The efficiency of flux depends mainly on its liability to coagulate such dispersed oxide. The action is generally stimulated by the production of chloride from chlorides in the flux which produce hydrochloric acid gas with the hydrogen in the metal. This gas, being insoluble, rises with the oxide to the surface. The evolution of nitrogen or fluorine from a flux may also be beneficial, and the gas itself in the former case may be bubbled through the alloy for stirring purposes, either in the furnace or ladle.

The addition of traces of alkali metal may modify surface tension, and such additions as chlorides or florides may be added shortly before casting, to increase the fluidity. Opalescent tints on the exposed surfaces of runners and risers indicate the presence of dissolved alkali metal, and, when these are noted, pinholing is very unlikely to be observed in the casting concerned.

Being in the nature of a survey, this Paper has touched on a wide range of subjects; consequently acknowledgment is due to many workers and authors; time and space make individual recognition impossible. The author would like, however, to record his indebtedness to Mr. E. J. Whitehead for photomicrographical work and Rolls Royce, Limited, for permission to publish this Paper.

TABLE III.—*Fluidity Test (Chill Mould).*

Volume of metal collected is taken as proportional to the fluidity.
Alloys not fluxed, cast from 690 deg. C. in mould at 180 deg. C.

	Alloy.	Volume.		Alloy.	Volume.
1.	Commercial aluminium (containing iron 0.30 per cent., silicon 0.22)	11.5 c.cs.	7.	2 per cent. manganese to No. 1	11.8 c.cs.
2.	Aluminium (iron 1.4 per cent., silicon 0.32) ..	12.8 c.cs.	8.	3 per cent. nickel to No. 1 ..	15.0 c.cs.
3.	2.5 per cent. copper to No. 1	12.6 c.cs.	9.	12 per cent. silicon to No. 1	*25.6 c.cs.*
4.	6.0 per cent. copper to No. 1	17.7 c.cs.	10.	24 per cent. silicon to No. 1	10.7 c.cs.
5.	12.0 per cent. copper to No. 1	*22.0 c.cs.*	11.	12 per cent. zinc to No. 1 ..	17.3 c.cs.
6.	6.0 per cent. magnesium to No. 1	18.6 c.cs.	12.	R.R.50 to No. 1	*22.5 c.cs.*

FIG. 21.—ALUMINIUM ALLOY CONTAINING ALUMINIUM-MANGANESE COMPOUND. THE ROUNDED FORM IS PRODUCED BY RAPID COOLING. × 150.

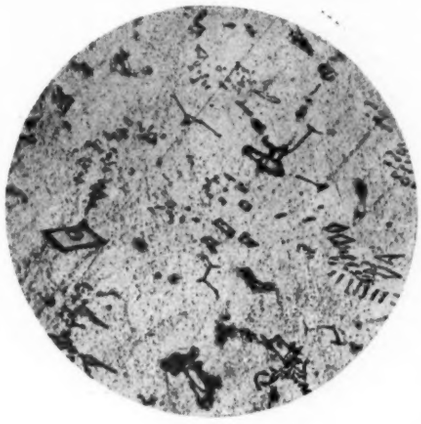

FIG. 22.—SAME ALLOY AS IN FIG. 21, BUT CRYSTALLINE STRUCTURE, PRODUCED BY SLOW COOLING. × 150.

TABLE IV.—*Solidification Range and Liquid Contraction for Various Alloys.*

Alloy.	Solidification Range. Deg. C.	Liquid Contraction. Per cent.
Aluminium (commercl.)	657 — 655 (2)	8.4
8 per cent. copper ..	620 — 550 (70)	6.2
12 per cent. zinc ..	620 — 590 (30)	5.8
12 per cent. silicon ..	570 — 567 (3)	3.4
4 per cent. magnesium	647 — 595 (52)	5.8
3 per cent. nickel ..	642 — 635 (7)	5.7
R.R. 50	630 — about 600*	—

* Less distinct owing to complexity of composition.

Some Experiences with Austenitic Cast Iron

BY A CORRESPONDENT.

In the course of some recent experimental work in connection with cylinder-bore wear in internal combustion engines, it was decided to test the efficacy of dry liners in an austenitic cast iron. The results of the first attempts made to fit these liners may be of some value to other workers.

An iron of approximately the following composition was chosen:

	Per cent.
Total carbon	3.4
Silicon	1.6
Sulphur	0.1
Phosphorus	0.8
Manganese	0.7
Nickel	14.0
Chromium	3.2
Copper	6.8

As delivered, the micro-structure of the iron was fully austenitic, and the material was not sensibly magnetic. Its hardness as indicated on a Rockwell machine was 10 C.

It was decided to employ a shrink fit, and, to facilitate insertion, to use liquid oxygen to cool the liner and so cause it to contract the necessary amount. The cylinder bores were machined to a diameter of 83.10 mm. and the liners ground to an outside diameter of 83.16 mm. to 83.185 mm. On endeavouring to press the liners into the bores after immersion in liquid oxygen (183 deg. C.), however, it was ascertained that growth had occurred; the outside diameter was then 83.5 mm. to 83.72 mm., while the length had increased to 0.80 mm.

Re-examination of the iron so treated revealed that it had become strongly magnetic, and that its hardness was 31 C. on the Rockwell scale. Subsequently micro-examination showed that the metal had reverted to the martensitic state, hence the increase in volume noted. The material had obviously been cooled below the alpha $\rightleftharpoons$ gamma transformation point.

It was still desired, however, to shrink-in the liners, so to avoid any further difficulties in connection with unwanted transformation, solid carbon dioxide was chosen as a somewhat less violent cooling medium; this substance was placed in a bath of white spirit, and a temperature of − 79 deg. C. was obtained. Liners immersed in the bath for some minutes and measured at once on withdrawal gave an outside diameter of 83.06 mm., and on regaining room temperature were found to have recovered their normal dimensions, the metal remaining non-magnetic. Micro-examination showed that no structural changes had occurred.

In the standard procedure finally adopted, an immersion period of 8 min. was chosen; liners were then found to drop for one-third of their length into the bores before binding took place, and light pressure from a hand press was found sufficient to drive them home completely.

Engineering Wages

At a conference held in London recently, the Engineering and Allied Employers' National Federation met representatives of between 30 and 40 engineering unions, most of which were represented by the Confederation of Shipbuilding and Engineering Trade Unions. The men made a general application for an increase in wages of 2d. an hour, with an equivalent advance to pieceworkers. The men also asked for a restoration of the conditions existing before June, 1931, and applied for the consolidation of the war bonus into the base rate. Another object of the conference was a discussion as to the best method of expediting future negotiations. To enable the employers to consider the unions' statement, the conference was adjourned until July 16.

D

The Artificial Lighting of Vitreous Enamel Plant*

By H. H. LONG

Although the factory department of the Home Office, the I.E.S., National Illumination Committee and like bodies, in company with the leading fitting manufacturers, have for years been studying the subject and publishing information, the present standard of illumination in factories is generally appallingly low. Whilst this applies to old installations, it is also unfortunately true in the case of many new ones, which have not been well planned. Works engineers may wish to be acquainted with the principles which follow, but to avoid unnecessary experiment and possible disappointment with the final result it is always wise to consult an expert illuminating engineer. The leading reputable fittings makers, who have made a speciality of industrial lighting offer this service gratis, and advantage should be taken of this fact whenever there are lighting problems to be considered.

Before commencing the planning of an installation it is necessary to appreciate fully the requirements of a properly arranged scheme. The real function of lighting is to enable the operative to see the detail of his work with speed and accuracy, and this renders a study of the detail of the work the first step. In certain industries, general lighting will provide adequate illumination for the work carried on, but in other cases it is necessary to provide supplementary lighting. Examples of this can be seen in the case of printing works where an Intensolux fitting supplies a beam of high light on the delivery end of the machine. This beam enables the minder to note defects in the printed letters during the very short passage of time that they are under examination.

It is proposed to indicate the principles involved in the drawing up of a lighting scheme, and to show how these principles are applied to the lay-out for the illumination of vitreous enamelling plants. The points influencing the design of schemes are discussed in turn as under:—

Adequacy

There has been much research and discussion upon the most suitable amount of light requisite for various industries. Table I gives an indication of good modern practice.

TABLE I.—*Recommended Illumination Values.*

0–3	Foot-candles.	—	Places where no work is done: passages, stairways, etc.
3–10	,,	,,	—For rough work: foundries, erection, schools, churches.
10–20	,,	,,	—For medium work: machines, benches, offices, shops.
20–30	,,	,,	—For fine work: toolrooms, typesetting, sewing machines.
30–50	,,	,,	—For extra fine work: engraving, drawing offices, inspection.

Uniformity

When the value of the illumination varies over the plane of work, the muscles of the eye become fatigued from rapid changes of accommodation to the lighter and darker areas. On this account, apart from the consideration of general appearance, the maintenance of uniformity is obviously important. Spacing/height ratios are published by manufacturers and these figures should not be exceeded. Closer spacing will result in better uniformity and more light on the working plane. As a guide to good modern practice, a figure of 70 per cent. can be taken for uniformity requirements. (The ratio used is the minimum to maximum illumination × 100.)

Diffusion

In locations where the avoidance of hard shadows is imperative, the use of large-source low-brightness fittings is advisable. Totally indirect lighting provides the nearest approach to maximum diffusion, but the most useful type of fitting to use in these cases is the glass steel unit which closely conforms to the above requirements. The type of reflecting surface plays an important part in the diffusion obtained, and for this reason vitreous enamel is usually employed. The best vitreous enamel has a reflecting efficiency closely approaching that of mirrored glass, and has a permanence and durability which is much more satisfactory than the latter when employed for works lighting.

Avoidance of Glare

It is well known that when looking against an motor-car headlamp, very little can be seen for some time afterwards. The same trouble in a more modified form is experienced by operatives when in the presence of lamps not equipped with correct reflectors. This state of affairs produces eyestrain and undue fatigue.

The foregoing deals with direct glare, but it is equally important that the glare should not be reflected from work. This can occur with semi-polished paper and is no way confined to the obvious such as bright metal parts and the like. Reflected glare can be avoided by using fittings of low brightness. These are usually of a large area, and good diffusion with the absence of glare are both attained. It sometimes happens—as with the inspection of polished sheets—that reflectors throw their light on to a wall or ceiling. This wall or ceiling then becomes the secondary source of large area and provides illumination for the work.

Direction

Directional lighting is imperative in certain types of work—this is best determined by a knowledge of the requirements under consideration. This directional lighting is usually best superimposed on the general lighting, though occasionally it is possible to obtain the desired result by providing a general lighting system with the light thrown all in one direction with angle fittings, as in drawing offices. These are cases where seeing is only made possible by the provision of shadows; examples of this are, the production of braille sheets and the inspection of light-coloured matte surfaces.

Influence of Location of Points

Modern gas-filled and electric discharge lamps provide adequate light output to allow reasonable spacing of fittings. This enables the design of general lighting schemes for almost all requirements. Subsequent experience, however, has shown the necessity for modifying these schemes and arranging the points to give satisfactory lighting on machines and benches, etc. By such a choice of lamp positions, good diffusion and penetration of light to the inner parts of the machines is obtained, and the possibility of having lamps directly behind the workers is avoided.

This type of localised general lighting can often be planned to give symmetrical lay-out, but symmetry should not become a fetish such that the resultant lighting is adversely affected. Whilst planning localised general lighting it is of value to take into consideration the roof construction, for by a slight compromise it may be possible to suspend the fittings from the trusses and considerably reduce the cost of wiring.

Technical Considerations

The technical data given here are those necessary to determine the correct size of lamp required to give a certain predetermined illumination value. A factor, known as the utilisation coefficient, is introduced in the calculations. The value of this factor is affected by the type of fitting, the type of room and the colour of walls in the room. It may be defined as the ratio of the total amount of light given out by the lamp to the amount of light available on the plane of work. An (R.L.M.) installation produces the highest coefficient of utilisation, because, firstly, the whole of the light is reflected on to the plane of work and, secondly, they are the most efficient reflectors of the type.

Since an illumination of one-foot-candle is produced by one lumen on an area of one square foot, it can be seen that the number of lumens required to produce a certain illumination can be obtained by multiplying the floor area per lighting point by required foot-candles. This figure when divided by the coefficient of utilisation will give the lumen output required per lamp, and on reference to the manufacturers' tables the correct wattage of lamp is taken.

Briefly then one can now summarise the chief points to be considered in the planning of a lighting scheme.

(1) Determine the lay-out of points on a plan, giving due consideration to the various factors indicated above, and locate the points according to plant lay-out and roof construction.

(2) Select the type of reflector most suited to requirements from a manufacturer's catalogue.

(3) Determine mounting heights for the spacing ratios chosen. If this comes out greater than the available height the scheme must be modified and the points closed up on the plan.

(4) Select the foot-candles which are considered adequate for the particular type of work under consideration.

(5) Determine the size of lamp required to give the necessary foot-candles.

Special Application

It is now proposed to give an indication of how these principles may be applied to the vitreous enamelling industry and to show how peculiar problems are given special consideration to ensure best seeing conditions.

In regard to the manufacture of frit, there is the possibility of the presence of dust and dirt in the atmosphere in this section of the shop.

* A Paper read before the Birmingham Section of The Institute of Vitreous Enamellers, Mr. A. England presiding. The author is on the staff of the Birmingham Electric Company.

For this purpose, the use of a general lighting scheme employing dispersive reflectors is recommended. In order to maintain the reflectors and lamps free from dust the use of a glass visor over the mouth of the fitting is advocated. This visor preserves the reflecting surface of the fitting and renders cleaning a minor operation since it is reduced to merely wiping over the face of the visor.

From recent experience it would appear that the use of visor dispersive fittings in the mill room will also prove satisfactory. The fittings in the room should be so placed that good illumination is obtained on and about the mills to facilitate charging and discharging. In the event of there being water present on the floors and in the surrounding atmosphere, it is wise to employ porcelain wellglass fittings in this section. These fittings provide adequate protection against moisture whilst at the same time the wellglass makes for easy cleaning.

The use of these last-mentioned fittings is clearly called for in the pickling shops. Here a steamy acid laden atmosphere is almost invariably encountered and for these conditions the porcelain wellglass fitting is eminently suited. Special consideration must be given to the lighting of the vats, for, in the majority of cases there is an exhaust hood over the top of them, thus excluding the possibility of using any illumination from a general lighting scheme. For this purpose the use of wellglass parabolic angle reflectors is recommended. These may be mounted on the wall below the exhaust hoods, but added protection will be afforded to the fitting if the hood be supplied with glass panels. The fittings may then be mounted outside the hood and the light will pass through the glass on to the vats below. Under these last-mentioned conditions only the minimum of acid and moisture is encountered by the fitting.

It has been noted that in the majority of cases, the dipping or spraying and firing of articles is carried out in adjacent parts of one building. The use of a general lighting scheme can be recommended in this section, and dispersive reflectors spaced from 1 to 1½ times the mounting height will provide uniform illumination which should have a value of 10 to 15 foot-candles. Provided the general lighting scheme is correctly positioned no additional lighting is required for the dipping vats. It is advisable, however, to replace the dispersive reflectors round about the charging forks and muffle with glass steel diffusing units. These fittings allow a softening of shadows and bright images in the fired ware—thus enabling rough inspection to be carried out round the muffles with the minimum of trouble. In certain cases hoods are provided over the charging forks and these tend to produce shadow round about the front of the muffle. The use of a parabolic angle fitting satisfactorily eliminates this trouble.

Illuminating Spray Booths

With regard to the spray booths, it is necessary to give special consideration to the lighting in this department. The main objects are:—(1) To avoid shadow in the booth; (2) to prevent glare, both from too much light and by insufficient shading; and (3) to find some satisfactory position for the light-source which will necessitate minimum cleaning and give freedom from damage.

Several methods of illumination for booths have been adopted, and here follows a brief description of these methods:—

(1) A glass top may be fitted and a Projectolux type of reflector mounted above this to give light through the glass on to the work below. In this case, the light is concentrated just where it is needed and the fitting is well clear of all contact with the spray. This method of lighting is well suited for use with explosive paints and conforms with Home Office Regulations.

(2) Parabolic angle reflectors, properly mounted, provide light over the shoulders of the operative and have the added advantage of giving plenty of light round about the floor area and surroundings for picking up and setting down work.

(3) The roof of the booth may be provided with an aperture in each of the two front corners. Small vitreous-enamelled reflectors are placed over these apertures and the light is thrown well down on to the work, while at the same time complete cut-off screens the operator's eyes. A scheme of this type, employing 60-watt pearl lamps, will give about 15 to 20 foot-candles on the work.

(4) In certain cases lighting of a more local nature is preferred, and to provide this local intensive reflectors are mounted inside or on the front of the booth. In cases of this description the reflector should be carried on an adjustable workshop fitting bolted to the booth. This will allow the position of the reflector to be changed at will to suit the wish of the operator.

(5) This last type of booth described is one without a top, in which "splash" spraying is done to give mottled effect. No exhaust fan is used, and the simple open construction reduces the problem of satisfactory lighting. Excellent results are obtained in this case by suspending a dispersive reflector above the work at such a height as to give cut-off below the level of the operator's eyes. Good uniformity is obtained, and if the correct size of lamp be chosen freedom from glare will result.

Inspection

The inspection of finished products should be given careful consideration, for in this department good lighting considerations will give increased speed and added accuracy in the locating of faults and blemishes in the fired ware. In order to minimise the difference between day and night conditions, artificial daylight should be provided; this colour correction of the light will enable inspectors to keep a fairly close check on the tone of coloured articles which may be inspected either by day or by night. The highest possible diffusion is necessary and all bright sources and glare should be eliminated in the inspection department. The fitting can be brought down to a fairly low level above the tables, and it will be found that the best conditions prevail when the largest possible areas are used as illuminants.

It is found with the inspection of polished surface material such as vitreous enamel that the actual examination is carried out by the image of the light source being reflected to the eye. For this reason it may be seen that low brightness fittings will avoid reflected glare, while a large area of light will give a larger image in the polished surface thereby allowing the inspection to be carried out more quickly.

The use of mercury electric discharge equipment is rapidly proving its value in inspection departments where colour discrimination is not important. This form of illumination has definite advantages over tungsten filament lamps, as greater detail can be perceived and higher speed of sight is obtained giving greater output in inspection departments. The light is deficient in red rays and contains a preponderance of green and yellow light with some blue. It is found that the eye sensitivity curve for the visible spectrum reaches its maximum in the yellow-green section and it is due to this fact that such high visual actuity is obtained.

Mercury discharge installations show themselves particularly suitable for the inspection of fired ground coat in vitreous enamel plants. Experiments recently carried out show that the bluish appearance of under-fired ground coat is made far more evident when mercury discharge light is used, than when employing light from filament lamps. Normally, fired surfaces appear a brownish-black while an overfired surface tends to become almost dead black. A comparison of faulty work was made under daylight conditions and under mercury discharge light. It was found that, though the bluish under-fired appearance was apparent in normal light, it was much more easy to detect this condition under the discharge light; and there is no doubt that unless very careful scrutiny was made, the work would have passed as satisfactory when the inspection was carried out under filament light.

The foregoing will serve to indicate how the principles of planned lighting may be applied to obtain the maximum utilisation from available light sources. As previously mentioned, the leading reflector manufacturers have made an extensive study of lighting problems in industry and advantage should be taken of their experience when considering the installations of new lighting schemes, or when modernising existing installations.

There are several reports by independent bodies confirming the value of good lighting in assisting the worker to produce more work of a better quality with less wastage. Added physical and mental well-being is also provided while the minimisation of accident risk is an apparent asset. But such confirmation should hardly be necessary if the foregoing has been appreciated and cognisance has been taken of the universal application of good lighting by the most successful manufacturers.

Points from the Discussion

MR. W. BACKHOUSE commented that he had often noticed the poorness of the lighting in the most important part of the enamelling equipment—the fusing section. Here, where the success of the operation was judged by the character of the gloss, lighting was usually very stereotyped.

MR. D. A. ANDERSON agreed that very little attention was paid to the lighting above the actual charging equipment. In the various works he had visited that week he had noticed that the fuser could tell whether the charge had been properly fired when it came from the furnace in its red-hot state.

MR. BACKHOUSE pointed out that in enamelling cast iron the operator looked along the surface, not from above it, so that he would be greatly assisted by irregular lighting to cause reflection.

MR. ANDERSON accepted this suggestion as one well worth investigating.

MR. A. B. ALLEN inquired what the difference in cost between ordinary lighting and mercury discharge vapour lighting was.

MR. LONG replied that it must be remembered that at five times the cost vapour lighting would be valuable to enamellers, because it revealed faults that could not be perceived with ordinary equipment. The vapour lamp combined the advantages of giving a sharp definition with a light comfortable to the eye. In practice, there were very few jobs in which the two types could be fairly compared. However, a 500-watt discharge equalled 1,000-watt filament lamp, i.e., with discharge lamps the same amount of light was obtained for half the power consumption. Also, the average life of a discharge lamp was 1,500 hours compared with 1,000 hours for a filament lamp of the same type. On the other hand, the capital cost of a discharge installation was twice as high, so that if the power was utilised for, say, only 800 hours a year, it would not be profitable to install discharge equipment.

MR. S. HALLSWORTH asked if Mr. Long's company had made any tests on the reflectivity of enamel reflectors and whether there was any relation between opacity and reflectivity of porcelain enamel reflectors.

MR. LONG said that by means of an apparatus which the firm had constructed, in conjunction with the National Physical Laboratory, which had a similar apparatus, it was possible to determine the total reflectivity of a sample piece of vitreous enamel. The actual figure was in the order of 85 per cent. Experiment had not yet provided an answer to the second question, but it had been ascertained that it did not follow that the more opacifier one put into enamel the better the reflection would be.

Vitreous Enamelling in the Soviet Union*

By J. H. GRAY

This Paper has been compiled from information which was received from the Soviet Union, obtained in answer to a lengthy questionnaire which the author submitted to the "Moscow Daily News." Unfortunately, the replies did not contain all the information sought nor were photographs of enamelling plants in Russia forthcoming.

It was thus only possible to obtain a limited survey of their methods of working, but it would appear that Russia is following closely on the lines adopted in this country and in the United States of America.

Vitreous enamelling in the Soviet Union began to develop on a commercial basis between 50 and 60 years ago. In the early stages, however, they were completely confined to the dry process of enamelling on cast iron. It appears that the credit for starting enamelling on a commercial scale must be given to four plants—the Kirov and Duminichi Plants in Western Province, the Khanin Plant in Moscow Province, and the Kasli Plant in the Urals. These four plants are still in existence and have, as may be expected, considerably increased in size since those early days.

They form part of large foundries manufacturing cast-iron kitchen utensils, sinks, washbasins, baths, and general cast-iron sanitary fittings. Altogether there are about twenty enamelling plants in the Union, the largest of these are situated in the following localities.

Typical Outputs

At Kirov the enamelling plant, which is attached to a cast-iron foundry, enamels kitchen utensils and building accessories. At the "revolutionary" plant in the Duminichi works, Western Province, baths, building accessories and chemical apparatus are enamelled.

Sheet iron enamelling is carried out on a very large scale at a plant in Rostov, where sheet-iron cooking utensils are enamelled after being fabricated in the main works.

In Moscow there are two important enamelling shops, the "Red Enameller" and the "Red Puncher" plants, and here general enamelling constitutes the production.

Unlike the conditions ruling in this country, there is apparently very little competition between the various plants, they are grouped under different Trusts, depending on the type or class of ware being produced.

All enamelling plants in Russia manufacture their own frits, and this is particularly interesting as the general trend throughout the world to-day is for enamellers to obtain their enamel supplies from frit manufacturers, who concentrate the whole of their attention on the production on high quality frits, while the actual enamellers devote their whole-time attention to the production, and to the quality, of the enamelled ware. As the vitreous enamelling industry advances in each particular country so this tendency appears more pronounced.

A study of future developments in the Russian enamelling industry, in this respect, will prove of considerable interest.

Post-Revolution Developments

It is probable that independent secret formulæ were used up to the time of the revolution, but when all industries in the Soviet Union were grouped together under the National Economic Policy and federations or trusts were formed, research work on enamels was conducted by the Institute of Silicates in Moscow and at the Ceramics and Metal Institutes in Leningrad. The objectives of these centres was to develop formulæ in order to use as much local raw material as possible.

Having completed this research, the formulæ were then issued to the various enamelling works to meet the particular production requirements of each. Since that time, however, these works have set up their own factory laboratories for the control of their frits and for the development of new frits to meet their individual needs.

It is interesting to observe that after exhaustive tests with both box-type and rotary-type frit smelters, it has been generally agreed that the latter is the more efficient, and the rotary type is now replacing the box-type wherever possible.

All cast- and sheet-iron frits used in the Soviet Union are leadless, lead-bearing enamels being prohibited in order to protect the health of the operators and of the general public. Well over 50 per cent. of the vitreous enamelling industry in Russia to-day is engaged on the production of cast-iron hollow-ware.

Works considering new enamelling equipment are in favour of continuous operation. At the present time nearly all plants operate 24 hours a day in three shifts, and the advantages of continuous furnaces and driers have not been overlooked.

Drying and Fusing

The Rostov plant, which produces sheet-iron hollow-ware, has already in operation continuous furnaces for both annealing and fusing. These furnaces are heated by means of producer-gas, and when new plants are under consideration for dealing with this class of work, it is anticipated that similar equipment will be installed.

At this plant continuous vertical driers have also been introduced. These are heated by air which is passed through heat inter-changers adjacent to the furnaces, utilising the waste gases for this purpose.

This method of drying is also planned for other works and has, therefore, no doubt proved beneficial in meeting the demand for increased production which exists throughout the industry.

Producer Gas

There are, however, a large number of batch-type enamelling furnaces still in operation. These are of a standard size according to the class of ware produced.

For instance, the size of the muffle for sheet-iron ware is standardised at 6 ft. 6 in. long, by 3 ft. wide, by 3 ft. high. For cast-iron ware the furnace dimensions are approximately 10 ft. long, by 3 ft. 6 in. wide, by 3 ft. high.

It will be observed that these furnaces are considerably smaller than those in general use in this country and in the United States. This is probably due to the fact that when the plants were installed the demand for enamelled goods was limited, and it will no doubt be remembered that up to recent years the furnaces in use in Great Britain were of smaller dimensions than those generally installed to-day, the 12 ft. and 15 ft. furnaces having become popular as the demand for enamelled ware has increased.

In addition to the furnaces of standardised dimensions already referred to, furnaces of a special size are built for the acid-resisting enamelling of large vessels which are to contain milk, etc.

In the majority of the enamelling furnaces in Russia, producer-gas is used, the producers being part of the installation at each works, and the gas is produced from coal or wood, depending on local and transport conditions. Oil-firing is also adopted in a limited number of plants.

The information given contains no mention of furnaces being heated by electricity and it can therefore only be assumed that this system of heating enamelling furnaces has not yet been introduced.

Sandblasting

All cast-iron ware is annealed and sandblasted prior to enamelling, and the pressures used in sandblasting are similar to those in operation here.

For low pressure work, as used in dry process enamelling, 25 to 30 lbs. per sq. in. pressure is usual, while for soft wet process, and acid-resisting cast-iron enamelling, 50 to 55 lbs. pressure is used.

After sandblasting, an undercoat is always applied, and this is either swilled or sprayed on to the ware by female labour. Female labour being employed in all plants in Russia, in compliance with Soviet laws, chiefly for cold work and where no physical strain is imposed such as, for instance, in the swilling and spraying of sheet and cast-iron enamels.

The ware is then processed as in this country, that is, it is dried, fused, allowed to cool, recoated, and then again fused. Cast-iron ware in Russia is usually finished in white, and sheet iron work is largely produced in white or pearl grey inside, with a dark mottle outside.

At present no sheet-iron ware is finished in an acid-resisting enamel, but a number of enamelling plants hope to bring this into production in the near future. Acid-resisting enamels for both wet and dry process on cast iron have been in production for a number of years, but in each case, as previously stated, they are applied over a ground coat.

Where it is possible to do so, both cast- and sheet-iron ware is suspended during fusing. Heat-resisting perrets and jigs are always used for this work in continuous furnaces. In the batch furnaces ordinary cast-iron perrets are chiefly used.

There are no "enamellers to the trade" in Russia; in other words there are no "jobbing plants," as all enamelling shops in the U.S.S.R. are parts of foundries or hollow-ware factories which enamel semi-finished goods of their own manufacture.

Raw Materials

The local C.R.C.A. pickled sheet is employed in all sheet iron plants in Russia, and the process of enamelling sheet-iron ware is carried out on lines similar to those adopted in this country.

In the Soviet Union the best iron analysis for light castings is considered to be:—C, 3.0 to 3.3; Si, 2.3 to 2.6; Mn, 0.5 to 0.6; S, 0.09 (max.), and P, 0.5 to 0.8 per cent.; and for heavy castings C, 2.9 to 3.0; Si, 2.0 to 2.2, with manganese, sulphur and phosphorus as for light castings.

On comparison, these analyses approximate closely to those in practice in some British foundries where castings are produced for enamelling. The percentage of phosphorus is usually slightly higher, however, in this country.

Enamel spraying, dipping, swilling, and fusing operators are considered skilled labour and wages are paid according to output and the quality of the work produced by each operative (probably by piece-rates). It appears quite possible that a female sprayer (skilled labour) earns higher wages than a male sandblaster (considered to be unskilled labour).

Imports

Only a very small amount of enamelled ware is imported into the Soviet Union, this consisting of special chemical vessels, although in the near future they are hoping, by producing it themselves, to be in a position to dispense with the importation of even this class of enamelled ware.

This again seems to prove that the Russians are losing no time in making themselves efficient in every branch of the enamelling industry, and

(*Concluded on page* 16.)

* A Paper presented to the Southern Section of The Institute of Vitreous Enamellers, Mr. V. C. Faulkner presiding.

System of Plant Operation to Reduce Enamelling Rejects*

By J. T. GRAY

In presenting this Paper it is intended to confine its subject matter, as much as possible, to what may be termed the incidental tools and equipment, their use and effect from the point of view of reducing rejects; and, in some degree, to methods of control in the enamelling shop. Whilst the necessity and importance of control has been stressed in previous Papers, the author is still of the opinion that there is not sufficient thought given to this aspect of operating some enamelling shops. When considering control, what has one to think about?

It is obvious that the job of the enamelling shop foreman is to control the labour and produce the ware to the required standard on the most economical basis. The sprayer's job is to spray; the fuser's to carry out fusing, and so on throughout the plant.

To control the production, it is not sufficient to know that the various operators are performing their duties. Something more is necessary if the enamelling plant is to produce ware of the required quality at minimum cost. It must not only be ascertained that each operation is performed on the prescribed lines, but that there is also some control over the materials and methods used, which will assist in the various operations being carried out efficiently and economically. Bearing in mind that the human element enters very largely into enamelling operations, and while it is not possible to eliminate this element, there are methods of control which can be introduced and operated for reducing the detrimental effects arising from a failure of this human element.

It is not suggested that it is necessary, or even economical, to adopt complicated systems or methods, but it is certain that if a number of the well-known, and, in some cases, continually-used methods were more generally adopted they would have a very definite bearing on the reduction of rejects, irrespective of the class of ware being produced.

It is easy to introduce a method of control, but it is not so easy to ensure its being carried out consistently. No system of control is effective unless it is conscientiously adhered to. It has been said that the installing of a mechanised foundry represented about 10 per cent. of the job—the other 90 per cent. was to make it work; and probably this is equally true with systems of control in enamelling shops.

Simple Tests

During this Paper it is proposed to explain, by means of diagrams, a few ideas which are simple in themselves, but can have a very definite bearing on the quality of the finished ware from the point of view of rejects. While some of these in their present form may not perhaps appeal to everybody, they may provide the germ of an idea for the development of a device to meet some special requirement.

These come into the same category as the pickling pills for testing the acid bath, and a number of similar simple but very effective means of control, such as the fineness test outfit for determining the grinding fineness of the enamel, the viscosity meter for testing the viscosity (or this can, of course, be done in a simpler form with the weight test, by weighing, say, a pint of enamel slop).

None of these ideas has been developed purely as an idea, but they are the result of careful study and observation of the need for eliminating defects which cannot always be directly attributed to the operator.

* Paper read before the Northern Section of The Institute of Vitreous Enamellers, Mr. H. Whittaker presiding.

Rejects through Mis-handling

A number of cases have been observed where a considerable proportion of the rejects was due entirely to mis-handling, either by the sprayer, the fuser, or the employees handling the work between the operators, which, on first sight, appeared to be due simply to lack of interest in their work. On closer investigation, however, it was sometimes found that this marking of the ware or chipping of the enamel by the operators was not entirely their own fault, but the fault lay primarily with the people in charge of the department, through their not having given sufficient attention to the methods of handling the ware in its various stages.

In a works with which the author is familiar steel grid trucks were used for conveying sheet-iron ware, and the space between the shelves was so confined that it was almost impossible to lift out sheets, say, 2 ft. by 2 ft. 6 in. without marking them, while smaller sheets, say, up to 18 in. square, could be handled quite comfortably. In other cases, a slight alteration to the design or the size of the sticks or trays has the effect of considerably reducing rejects through marking.

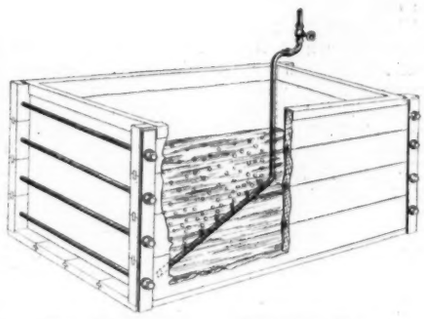

FIG. 1.—DESIGN OF PICKLING TANK INCORPORATING AERATION.

In some works it is the practice for the fuser to "touch-up" any small marked places, and while this is sometimes carried out very well, it does not improve the appearance as compared with unmarked ware, and it very often results in rejection after firing, whereas if the necessary care—and it should be emphasised, care and forethought—were taken in providing the operators with the correct tools, and giving necessary thought to the arrangements for handling the ware, a considerable proportion of rejects from this cause would be eliminated.

Unskilled Labour

It is a common failing to underestimate the importance of what may be termed the non-productive labour in the enamelling shop; that is, the man, boy or girl whose job it is to push trucks of ware between the various operations, yet these employees are very important links in the chain of operations. There are instances where new labour of this class has been started without previous experience, and the foreman has just given them brief instructions as to their duties or detailed some other operator to show them what to do; it may be carrying work from the sprayers to the dryers, or from the dryers to the furnaces, and so on. They consider that these brief instructions, probably taking but a few minutes, are sufficient. This often results, however, in the new hands marking the ware for a number of days or even weeks; and having started in the wrong way it is more difficult to correct them than if they were properly trained initially. If the necessary time had been spent in properly training these new hands—it could be done in a day or two—many rejects or spoilt work would be prevented, with a saving of time and money. The time taken in thoroughly training such workpeople would prove much less than that necessary for continually correcting them over long periods.

Hard-and-fast rules cannot be laid down for general application throughout the trade; owing, of course, to the vast range of types and classes of ware which call for various systems of production. It can, however, be said that if close observation be maintained on the small items of control, it will assist materially in the smooth operation of the plant and in a reduction of rejects. To demonstrate this it is felt that a few instances from personal experience will be of value.

Defects from Shotblasting

From time to time the author has been called upon to investigate what appeared to be serious problems, but in a number of such cases the solution has been found by the introduction of some comparatively simple form of control in certain sections of the plant. For instance, one works making a fairly large production of cast-iron enamelling by the wet process, at one period was troubled with an abnormally high percentage of rejects. They manufactured their own enamel, produced good quality castings, and the enamelling shop was well controlled. The investigation ultimately led to the shotblast, and here the solution was found.

The trouble was due simply to the fact that the nozzles were being used an excessive length of time beyond their useful life, thereby causing a reduction in air pressure, which resulted in the surface of the castings not being thoroughly prepared, although in appearance they looked quite satisfactory. Long-life nozzles were introduced, definite working hours were set for the nozzles by test, and the difficulty was overcome without any recurrence. Whilst every other operation was carefully controlled, in this particular instance the shotblast happened to be the overlapping point between the foundry manager and the enamelling shop foreman.

Defects from Pickling

In other cases where difficulty has been experienced in sheet iron production, including fish-scaling, blistering and similar troubles, the solution has been easily traced to the pickling room, and the correction and prevention of this trouble recurring has been achieved by the introduction of a simple system of operation there.

No set rule can be laid down to control all pickling operations, but in these cases the acid strength required was determined, the time for immersion of each class of ware in the various solutions was set, a standard acid test by means of pickling pills was introduced, periodic cleaning out and renewing of the various solutions was agreed upon, with the result that there was no recurrence of these troubles.

Attention is drawn to a known and simple system of increasing the efficiency of the acid tank, where cold hydrochloric acid is used by aerating the solution. This is done by running a small air supply to the pickling room, and allowing the air to escape into the bottom of the tank so that it bubbles up through the acid solution.

A method of doing this is to run, say, a $\frac{3}{8}$- or $\frac{1}{4}$-in. air pipe, and have a length of Monel metal tube running along the bottom of the tank with a number of drilled holes for the air to escape into the solution, as shown in Fig. 1.

Dipping Ground Coat

A large number of difficulties have been experienced through inconsistent sheet iron ground (grip) coat at the dipping tank. Most enamellers have encountered difficulties at this stage in the production at some time or another, and such a

case existed in a large and long-established works controlled by a man who had had very wide British and American experience. There was no doubt that this man was manufacturing a good enamel of his own composition and was using a high grade enamelling iron. At one period he met with a persistent difficulty, and some three days were spent in checking up through the various operations.

He invited the author to collaborate with him in tracing the source of the trouble, and explained all the checks he had made throughout the department. It did at first appear that everything was correct, but an examination of the ground coat dipping tank revealed the cause of the trouble—the grip coat was too thin. It had been sent out from the mill room apparently

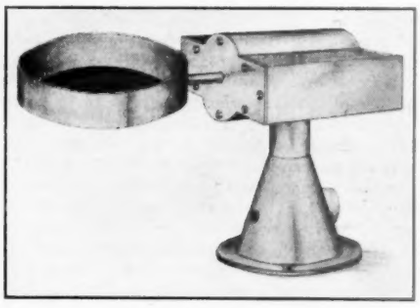

FIG. 2.—A SIMPLE SIFTING MACHINE.

correct, but as is often the case, the dippers went on dipping too long without stirring the enamel, and it was also suspected that too much water had been added either at the dipping tank or at the mill.

Had there been in operation the simple and fairly well-known method of testing the dipping weight of the ground coat by taking a sheet two square feet in size, that is 17 in. by 17 in., weighing it, recording this weight, dipping it into the ground coat, and allowing it to drain, and again weighing it while wet, then the difficulty which was being experienced in these works would not have occurred.

Standard Weight

Here again no set weight can be given for this method of testing, but it is claimed in some quarters that 3½ ozs. of grip coat on two square feet is the best weight, but cases have been encountered where 3¼ ozs. was a satisfactory weight and others where the weight was as much as 6½ ozs. Therefore the most satisfactory method of determining the correct weight for an individual plant is for each works to ascertain their enamel working correctly, check its weight, and then standardise on that particular weight. Of course the enamel weighed is on both sides of the sheet.

There is a simple, inexpensive, but effective method of ensuring consistent grip coat at the dipping tank. This is by means of a simple circulating system which can be carried out by taking a 1½-in. (gas) pipe from the bottom of the grip coat tank, either in the centre of from one of the front corners, running it along underneath the tank up the back of the tank and turning it over so that it discharges into one of the back corners of the tank above the level of the grip coat. A sieve, say 8 in. square, with a 20-mesh lawn can be fixed in the corner of the tank below the discharge from this pipe. A ¼-in. air supply is fitted into the 1½-in. circulating pipe at the bottom bend where is rises up the back of the tank. When the tank is filled with grip coat enamel this will fill the circulating pipe up to its own level. The air from the ¼-in. inlet pipe should then be turned on and regulated so that it flows up the rising pipe at the back of the tank, and this will have the effect of causing the grip coat to flow very slowly through the circulating pipe, and by means of this continuous circulation and sieving the grip coat is kept free from any foreign matter and settling is prevented. It is not necessary to cause a rapid circulation, but if the contents of the tank are completely circulated, say, once every two hours, this will be found sufficient, but the speed of circulation can be regulated by means of a valve on the air supply.

Mill Room Operation

The method of operation in the mill room is outside the scope of this Paper, and has been dealt with in previous Papers* read before The Institute of Vitreous Enamellers, but in view of all that has been written in text-books, and said at previous meetings of the Institute on the subject of mill room control, the author has been rather impressed from time to time at having been called in to investigate and correct troubles which have been due simply to lack of control in the mill room.

For instance, the method of testing the fineness by using a 50 ml. breaker, 150-mesh sieve, and a graduated test tube, is so well known that it seems almost superfluous to mention it, but it is surprising how frequently one finds mill rooms in which the use of this simple method of ensuring a consistent fineness has been introduced, and those in the mill room have been allowed to become slack and to ignore its use.

There is no wet process enamel ground for use in any branch of the enamelling industry which would not benefit by the constant use of this simple and inexpensive method of testing. The fineness to which the enamel is to be ground for each individual job can only be found by experience with the particular enamel and the class of work for which it is required; but once this is determined it should be rigidly adhered to.

A Hollow-Ware Defect

There is a common defect met with in the hollow-ware trade, in some classes of ware, which is generally termed "water-lining," and this is particularly prevalent on the insides of vessels having narrow necks. While this is to a considerable extent due to the fact that the water vapour from the grip coat is trapped inside the vessel during drying, the introduction of the swilling weight test, and the grinding of the

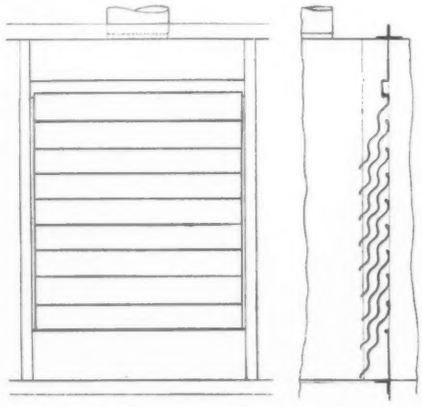

FIG. 3.—BAFFLE ARRANGEMENT FOR SPRAYING BOOTHS.

enamel to a definite fineness, has had a marked effect in reducing rejects from this cause. In fact in some classes of ware such as reflectors, where a certain amount of this water-lining was being experienced, the introduction of these methods completely eliminated the trouble.

Before passing from the mill room it is necessary to stress the advisability of careful sifting of all enamels before distribution. It is not sufficient to pass the enamels through a sieve. Each enamel should be passed through a sieve of a particular mesh, according to the fineness of the enamel and the work for which it is required. For instance, a cast-iron enamel for application direct to the iron can be efficiently sieved through a 30-mesh or 40-mesh lawn, whereas a mottling enamel or a cover coat enamel should be passed through a much finer mesh—say 60-mesh. Such a machine for the sifting of small quantities of enamel is shown in Fig. 2.

Defects from Spraying

The spraying section of the average enamelling shop usually receives rather more attention than other sections; but even so it may not be out of

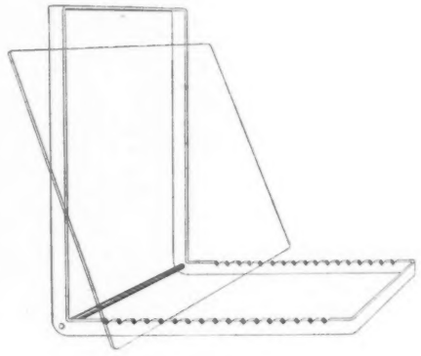

FIG. 4.—JIG FOR SPRAYING SHEET.

place to add to what has previously been said on the far-reaching effect of good ventilation and good lighting in the spray booths. As a result of careful observation and test it is a personal opinion that the velocity of the air at the mouth of the vitreous enamelling spray booth should not be less than 110 cub. ft. per min.

From the point of view of economy, efficient enamel baffles should be used to prevent an excessive amount of enamel being drawn into the exhaust system.

On some spray booths the velocity of the air is purposely reduced to prevent a large amount of enamel dust being drawn into the exhaust, and this reduction of velocity is of course detrimental both to the operator and to the quality of the ware.

Some people seem to be under the impression that if effective baffles are employed, a comparatively high horse power will be absorbed in driving the exhaust-fan. This, however, is not the case. There are available designs of baffles which allow for a high velocity of the air to be maintained at the mouth of the booth, they are effective in trapping the enamel dust, and at the same time they do not offer an excessive resistance to the air-flow. A design of such a baffle is shown in Fig. 3.

Sprayers' Jigs

What may be termed sprayers' jigs are another important factor to which managers of enamelling shops could devote attention with profit. Very often a little thought will result in the development of some simple device which will assist the sprayers to finish their work without marking, and very often at the same time speed up the spraying operation, and in this connection attention is drawn to Fig. 4, showing a very simple form of spraying jig which can be used for sheets, and, in some cases, for cast iron, and which to some extent simplifies the spraying operation.

Brushing-off Jigs

Referring now to Fig. 5, showing a type of brushing-off jig, it will be seen that this is a very simple but effective device for brushing-off plates with a radius at the corners. The edges

(*Concluded on page* 16.)

* "Millroom Practice," by B. B. Kent, FOUNDRY TRADE JOURNAL, February 4, 1937, p. 124.

IN THE INTERESTS OF THE WORKERS

Talk No. 2.

Blythe Cricket and Tennis Clubs,

Good colours enforce good working conditions

We made up our minds some years ago that "Blythe" Colours were good. We arrived at this opinion because of the very large and consistent orders which came to us. As our sales keep extending from year to year we have seen no reason to change this opinion.

We felt, however, that it was possible still further to improve upon our colours—our research department was doing all in its power to make this possible—our workers were doing their best to carry out the proper instructions in a most painstaking way, but even then, we still felt that we could carry the improvement further.

We had always made a point of looking after our work-people, first, because it always pays to do this, and second, because we like to do it. We pursued this matter further, with the result that to-day they have playing fields, tennis courts, a canteen, and room for indoor amusements.

Amongst our staff we have enough enthusiastic footballers to provide three good teams, whilst in the Summer our cricket teams manfully uphold the prestige of "Blythe" Colours.

We have found that by making better working conditions we have increased our output, improved our products, and created an atmosphere of goodwill which runs throughout the entire works.

When you specify "Blythe" Colours you know that they are being made of the highest quality materials under the very best working conditions, by people whose sole object is to produce good colours that will help you to do good work.

We are always pleased to see at our works or at our sports ground any user of "Blythe" Colours. They can look around and see for themselves the ideal conditions under which all our products are made. Let us arrange a visit.

Blythe COLOURS

BLYTHE COLOUR WORKS LTD

CRESSWELL, STOKE-ON-TRENT

of the plates are brushed off in the usual way by means of edging brushes, a piece of stencil metal or zinc is cut to the required radius and secured to the underside of the sliding strip, the plates are put into the jig, the sliding strip lowered on to the plate, and the corner brushed off with an ordinary stencil brush.

This is very simple in construction and operation, every corner of the plate is brushed off to the same radius, and this method eliminates the necessity for measuring and marking. This may not be of service to a number of enamellers in its present form, but it may very well form the germ of an idea for the development of some other types of tool or jigs to suit a particular class of work.

Drying Problem

In plants where the oven- or box-type dryer is used numerous cases have been encountered where a considerable number of rejects have been caused through marking of the ware in the dryer. This can be avoided to a very considerable extent if more forethought is applied to deciding the design and size of the dryers, and the position of the doors.

When continuous dryers, either of the horizontal or vertical type, are under consideration, the method of handling the ware in and out of the dryer and the design of the carriers receive a good deal of attention; and this naturally has its effect on the reduction of rejects, whereas with the simpler type of box-dryer this aspect of the matter is liable to be overlooked.

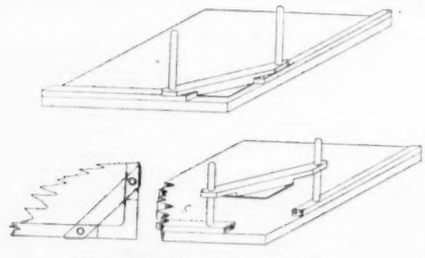

FIG. 5.—BRUSHING-OFF JIG.

The method of handling the ware at the furnace should have constant attention, particularly so as it is the last phase in the enamelling operation, and rejects here are more costly than in earlier stages of production, and it is felt that this could well be made the subject of a future Paper.

A system could be thought out and adopted for delivering and stacking the ware around the furnace so that the fusers can select their loads without undue shifting of unfused work, or lifting pieces of work from various trays, as this is always liable to cause marking. The perrets or fusing jigs, whichever are used, should be carefully selected or designed to suit the class of ware being fired.

The method of loading the ware according to its design is worth attention, and emphasing to the fusers the necessity for correct loading is time well spent. For instance, in the case of castings, where possible heavy castings or castings with heavy lugs should be fired in one load. The mixing of light and heavy castings should be avoided.

Where the firing of double-decked loads is practised the top deck or layer of castings should always be loaded first, as if the bottom layer is loaded first there is the possibility of scale, dust, or other coloured enamels falling on to the bottom castings while the upper layer is being loaded.

In cases where the work is suspended during fusing and mixed loads cannot be avoided, the heavy castings, or those with heavy lugs, should be loaded on to the outer edges of the perrets. These are simple well-known suggestions, but unquestionably their importance is not always sufficiently emphasised to the fusers.

Temperature Control

Temperature control has entered very largely into the enamelling trade of late, and there is no doubt that automatic temperature control is worth while if only from the point of view of a reduction of rejects through over-firing. In any case, where automatic temperature control is not possible or practical, either recording or indicating pyrometers should always be used.

Throughout this Paper the author has essentially put forward only simple systems of control which do not involve increased cost in operating the plant. He is confident that the methods suggested will reduce rejects and thereby reduce production costs; while most of the small appliances recommended can be home made at very small cost. He has also tried to deal with the practical side of production, and has deliberately avoided the highly technical or theoretical aspect of the enamelling process.

In conclusion, an endeavour has been made to emphasise the necessity for constant attention to the simple and well-known maxims of control in the enamelling shop.

Vitreous Enamelling in the Soviet Union

(*Concluded from page* 12.)

are using every effort to make themselves completely independent of foreign supplies, while it is probably safe to say that they are, at the same time, keeping a close watch on British and American activities in the enamelling field.

No enamelled goods are exported from Russia as the demand of the internal market is extremely high and completely absorbs the home production. It is of interest to learn that the vitreous enamelling industry in the Soviet is looking forward to a great future.

One of the reasons for this is the rapid development of industrial and housing construction. The building of new cities and settlements and the reconstruction of old ones is also proceeding as rapidly as possible. A further reason for the optimistic outlook of the Russian enamelling industry is the greatly improved material and cultural conditions of great masses of the people.

In view of all this a large number of enamelling plants are now under consideration in different parts of the country, while plants already in existence are extending their works and installing more up-to-date equipment.

Limited Production

Bearing in mind that continuous furnaces and driers are in operation and that great strides have been made in other directions, it is rather surprising to learn that up to the present no cookers, refrigerators, or kitchen ranges have been produced with a vitreous enamelled finish. It is, however, of interest to note that plans are being made to produce these in the near future.

Referring again to the non-production of enamelled kitchen ranges, cookers, and similar articles, this is probably due to the fact that no wet process cast-iron enamel is applied direct to the iron, and it would probably prove too expensive to enamel these over a ground coat.

The fact that all research work was carried out first by Institutes in Moscow and Leningrad, and that later all factories set up their own laboratories, seems to prove that they, like ourselves, realise how imperative it is to have all sections of the plant under strict control.

Most of the literature appertaining to the vitreous enamelling industry in Russia consists of abstracts from American and German publications, and it appears that the Russians themselves have contributed very little in this respect. The advance that has been made in the industry in Russia during recent years is due to the fact that there has been widespread co-operation between the various manufacturers.

In conclusion, the author wishes to acknowledge, with sincere thanks, the co-operation which has been extended to him by the Russian authorities.

Metals Look Cheap

BY "ONLOOKER."

In this world of ever-changing values it is fatally easy to lose one's sense of proportion. This appears to be happening at the present time in the realm of non-ferrous metals, for, after rocketing to abnormally and absurdly high levels, prices have lately been plunging downwards in a manner which strongly suggests that in its turn the fall is being overdone. At the top of the up-swing many observers foresaw a still greater appreciation in value, and now, when it may well be that we are bumping on the bottom, voices are heard to declare that the downward swoop is far from finished. Although the extremist may be in the minority, his view often enough appears to reflect majority opinion, and, looking back over the past few months, it is not surprising that moderate counsels are out of fashion. We have been living in a whirl of excitement which makes the policy of sticking to the middle of the road appear humdrum and probably bad tactics.

Present Price Levels

The title of this article suggests the view that at their current levels metals are cheap, and this means in effect that they are under-valued and therefore likely to appreciate. At the moment standard copper is around £56, with the backwardation virtually off, and electro is an easy £62 10s. From these levels a further decline seems to be not at all impossible, and the round figure of £50 for warrants may well eventuate either this month or next. There is, however, every likelihood of an early return to a measure of output restriction. In fact, it is currently reported that a cut to 105 per cent. was actually planned to take effect from June 1, this scheme only being dropped because the British Government raised objections to the cutting down of Empire supplies. The time must be fast approaching when supplies will be so adequate that a plea of a threatened shortage will not be tenable, and, in fact, the position such that to continue a go-as-you-please policy in production would bring a decline in the quotation so severe as to upset matters just as seriously as the abnormal rise.

Case of Copper

At what stage the copper producers will decide that the time is ripe to reintroduce restriction it is impossible to say, but let those who are delaying their purchases remember that the curtailment machinery exists, and it is believed that, in spite of reports to the contrary, there is sufficient unanimity among the copper people to facilitate speedy action. One thing does seem fairly certain, that action will be taken long before the bottom drops out of the market. In spelter and lead the position is rather different, but at the time of writing the former is about £22 10s. and the latter about 30s. dearer. Both of these metals have suffered a decline of approximately 40 per cent. from the top, and although there is no question of their returning to those inflated levels, the statistical position, especially with regard to early dates, is such that a modest recovery can hardly be delayed much longer. On any turn we believe that sellers would be very reluctant, and should consumers prove to have been unwise enough to land themselves in a vulnerable position, then a really sharp turn might well take place. There is no space to consider the influence of the gold position, but doubts about the price of the precious metal ought to be resolved soon, and this would clear the way for a recovery.

VULCAN FOUNDRY, LIMITED, Newton-le-Willows, has secured an order for 20 steam locomotives and tenders for the Buenos Aires Railway, and five locomotives and tenders for the African Gold Coast Railway.

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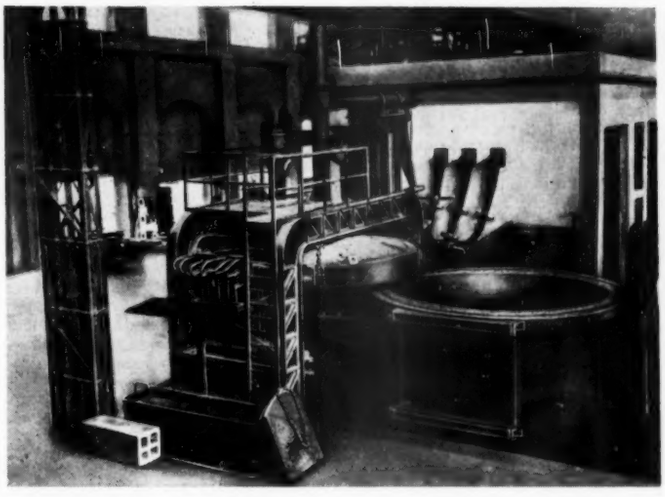

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This Week's News in Brief

Trade Talk

ABOUT ONE HUNDRED EMPLOYEES of J. & R. Wallace, The Foundry, Castle-Douglas, Scotland, held their annual outing recently to Carrick Shore.

A NEW TECHNICAL COLLEGE is to be built in Birmingham, the first instalment of which is to cost £500,000. It is to be situated in New Corporation Street.

MEMBERS OF THE American Foundrymen's Association are to visit the Great Lakes Exhibition at Cleveland on August 12. A dinner is being organised in connection with this event.

ACCORDING TO Press reports, the Duffield Iron Corporation, Limited, of London, has formed a subsidiary to smelt the titaniferous iron sands, which abound on the West Coast of New Zealand.

THE IRON AND STEEL INSTITUTE are to hold their Autumn Meeting at Middlesbrough from September 14 to 17, under the presidency of Mr. Alfred Hutchinson, M.A. A number of important foundries are to be visited.

THE TWENTY-NINTH autumn meeting of the Institute of Metals will be held in Sheffield from September 6 to 9. Prof. J. H. Andrew, D.Sc., is chairman of the Reception Committee, which has been formed to make the necessary arrangements for the meeting.

THE FOURTEENTH annual general meeting of the Institute of Welding is to be held in the Hall of the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, on July 14, 1937, at 5 p.m.

BARCLAY, CURLE & COMPANY, LIMITED, Glasgow, have received an order for an 11,000-ton troop-carrying and passenger liner from the P. & O. Steam Navigation Company. The propelling machinery will consist of Doxford Diesel engines, and is to be constructed by the builders at their North British engine works.

HURST NELSON, LIMITED, Motherwell, have secured an order for 50 steel bogie tank wagons, to be used for the transport of petroleum for the Buenos Ayres Great Southern Railway. The Assam Bengal Railway have also placed an order with Hurst Nelson for 96 pairs of wheels and anxles for bogie petrol tank wagons.

ADDRESSING THE MEMBERS of the Middlesbrough Round Table last week, Mr. Arthur Dorman, a director of Dorman, Long & Company, Limited, referred to warrant stores, and said the end of this system was brought about not by any action of the makers, but through the change which had taken place in the geographical production of pig-iron. He expressed the opinion that pig-iron exports would never again reach their old proportions.

THE OPINION that Jarrow has not the skilled men necessary to deal with the new £1,000,000 mill to be laid down for the manufacture and rolling of steel has been expressed by Mr. A. Edwards, Member of Parliament for Middlesbrough East. Although details of the scheme were not yet available, he said that steel billets were to be brought to Jarrow for re-rolling; they were not to be made there. Mr. Edwards discounted the view that the new works would attract other industries to Jarrow, and he pointed out that Middlesbrough was better situated than Jarrow, and had still 20 per cent. unemployed against Jarrow's 30 per cent.

LAST TUESDAY, a party of about thirty of the staff and students of the metallurgical department of the Sir John Cass Technical Institute, London, visited the works of the Ford Motor Company, Limited, at Dagenham. During the morning the visitors were shown over the blast-furnace, coke-oven and sintering plant, whilst the afternoon was spent in the foundries and the new rolling mills. Mr. H. A. Fox and Mr. J. N. Burns received the party. Mr. G. Pachin, A.R.S.M., M.I.M.M., the Principal, and Mr. L. Singlehurst Ward, on behalf of the students, very cordially thanked the management of the Ford Company for the many courtesies extended to them.

IN OUR LAST ISSUE, under the heading of "Wills," we stated that Percy William Allday, deceased, was a director of Allday & Onions, Limited, engineers, of Small Heath, Birmingham. We are now informed that the gentleman mentioned, at the time of his death, was not a director of this company, neither did he have any financial interest in it.

Company Meeting

James Keith & Blackman Company, Limited

Speaking at the 48th ordinary general meeting of James Keith & Blackman Company, Limited, manufacturers of cupola blowers, etc., held in London last Friday, Mr. George Keith, chairman and managing director, said that during the financial year under review there had been a substantial increase in the volume of business done. This had reflected itself in the fact that the net profit shown was 65 per cent. higher than for the previous year. The year's output was the highest in the history of the company. The difficulty in dealing with the present volume of business at the company's Holloway works had necessitated the purchase of 11 acres of ground at Ferry Road, Tottenham. When completed these works, which had been designed to ensure continuous production from the arrival of the raw material to the dispatch of the finished product, would be twice that of the present Holloway works. It was expected that the scheme would be completed in 18 months' time. It was proposed to increase the nominal capital of the company to £500,000, and in order to finance this scheme the directors propose to issue 100,000 new £1 5½ per cent. cumulative preference shares, and 100,000 new 10s. ordinary shares. Application which had been made for a quotation of preference shares on the London Stock Exchange has been granted. The net profit figure at £50,367 shows an increase of £19,779 over the previous year. The directors recommend that a dividend on the ordinary shares at the rate of 20 per cent. less income tax be declared.

At a subsequent extraordinary general meeting resolutions were carried unanimously, changing the name of the company to Keith Blackman, Limited, sub-dividing the existing £1 ordinary shares into two shares of 10s. each, authorising the increase of the capital of the company to £500,000 by the creation of 150,000 new 5½ per cent. cumulative preference shares of £1 each and 200,000 ordinary shares of 10s. each, and adopting new articles of association.

Keighley Firm Celebrates Centenary

Clapham Brothers, Limited, ironfounders and gas plant makers, of Wellington, Market and Nelson Foundries, Keighley, have just completed their centenary. Throughout the century the Clapham family have retained direct interest in the business which was begun in 1837 by Thomas, John, and William Clapham, whose descendants control the firm to-day along with the associated company of John Lund & Company, Limited, of Eastburn Foundry, near Keighley.

For about 56 years, the original partners were in control and Mr. Thomas Clapham, the second brother, developed the gas making plant. The sale of six purifiers, each 30 ft. by 24 ft. to the Corporation of Bradford in 1878 began that important branch and in less than ten years forty-two purifiers had been supplied to Bradford while large contracts had been carried out for the Southport, Stratford and Lincoln Corporations. The firm's largest contract was obtained 16 years ago when material to the value of £100,000 was supplied to the Govan works of the Corporation of Glasgow.

Three foundries were long operated—the Wellington Foundry for gasworks plant; the Nelson Foundry for the manufacture of vertically-cast sockets and spigot pipes from 3 to 24 in.: and the Market Foundry for light castings. All three were continued until 1912 when the vertical pipe casting plant was closed down and Nelson Foundry converted into general foundry for gasworks plant. In 1932, the firm took over the business of John Lund & Company, Limited, of Eastburn Foundry.

SIR ARTHUR AITON, managing director of Aiton & Company, Limited, Derby, and Past-President of the Derby and Derbyshire Chamber of Commerce, is a delegate to the ninth Congress of the International Chamber of Commerce in Berlin.

Personal

MR. TH. TEISEN, of 20A, Temple Street, Birmingham, 2, has changed his address to Eckersall Road, King's Norton, Birmingham.

MR. OLIVER SMALLEY, the well-known metallurgist, and H.M. Consul at Pittsburgh, is expected to arrive in England during next week.

DR. A. B. EVEREST, President of the London Branch of the Institute of British Foundrymen, is to visit the United States in the near future.

MR. T. HOLLAND NELSON, a Sheffield trained metallurgist, has been made a director of the Philadelphia Chapter of the American Institute of Metals.

MR. JAMES PETTIGREW, departmental foreman with the National Steel Foundry, Limited, Kirkland Works, Leven, has obtained an appointment with a Sheffield engineering firm.

THE LORD MAYOR OF DÜSSELDORF has sent to many of his British friends an invitation written in English to visit the Schaffendes Volk (A Nation at Work) Exhibition now being held in that city.

MR. ALAN MUNRO has been appointed foundry manager with Brown Bros. & Company, Limited, Rosebank Works, Edinburgh, in succession to Mr. J. Simpson, who died recently. Mr. Munro has been assistant works manager with this firm for some time.

GENERAL THE HON. SIR HERBERT A. LAWRENCE, G.C.B., has resigned his seat on the board of Vickers, Limited. Mr. J. Reid Young, C.A., has been appointed a director. He has been secretary of the company since 1929, and will continue to hold that office.

Obituary

MR. ALBERT E. S. HOUSE, managing director of Swift & House, Limited, engineers and ironfounders, of Newtown, Wigan, was found dead at his home last Thursday. He was 62 years of age.

THE DEATH HAS OCCURRED of Mr. Archibald Penman, at the age of 81. He went from the West of Scotland 20 years ago to take up an appointment with the National Steel Foundry, Limited, at Kirkland Works, Leven, with which firm he had since been employed.

MR. E. WILLOUGHBY FIRTH, the second son of the late Mr. Edward Firth, and a grandson of Mr. Thomas Firth, who, with his sons, founded the Sheffield steel firm of Thos. Firth & Sons in 1842, died at Bournemouth on June 18, in his 71st year. For many years Mr. E. W. Firth was engaged in the active management of the firm, and when, at the end of 1934, he retired from the board of Thos. Firth & John Brown, Limited, it was after a directorate of 41 years, and nearly half a century's service in all. Mr. Firth took a keen interest in the welfare of the firm's employees, and helped forward many organisations which had that object in view. He was actively associated with many organisations in Sheffield, being prominent in musical circles.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Resisto Metal, Limited.—Capital, £2,500. Subscriber: D. D. C. Giddins, Thaxted, Queenscourt, Wembley.

Walters & Dobson, Limited, 49, Bailey Street, Sheffield, 1.—Capital, £12,000. Ironfounders, mechanical engineers, etc. Directors: B. Walters and W. M. Dobson.

Taylor & Osborne, Limited, 245, Berners Street, Birmingham, 19.—Capital, £1,500. Manufacturers of ferrous and non-ferrous metals. Directors: L. W. Taylor and T. N. Osborne.

Taylor & Bodley (Exeter), Limited, 67 and 68, Commercial Road, Exeter.—Capital, £7,000. Engineers, ironfounders, etc. Directors: A. B. Green, J. H. F. Nichols and H. E. E. Holladay.

Lucas & Peace, Limited.—Capital, £1,000. Manufacturers of hardening and other furnaces, stoves, boilers, etc. Directors: W. H. Peace, 102, Millhouses Lane, Sheffield; W. B. Peace and F. E. Lucas.

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Raw Material Markets

Consumers, whether of iron or steel, do not find it any easier than before to place fresh business. Producers are doing what they can to meet requirements, but arrears of deliveries are inevitable in some cases. Rationing of supplies of pig-iron on the 1936 basis, while fair and equitable and satisfactory to that extent, leaves out of account increased requirements due to improved trade. Inquiries abroad are the result, and iron has been brought in from the Continent and the United States at prices considerably above the home rates. There is not much Continental iron available, and high figures have to be paid to obtain the limited supplies. There are many offers of American foundry iron, but these are mostly of low-phosphoric grades, whereas high-phosphoric iron is needed more. Here also prices are high.

Pig-Iron

MIDDLESBROUGH.—Slackness in the Cleveland iron market is due less to seasonal causes than to the inability of the furnaces to release larger quantities of pig-iron. With the steel industry so busy, and most of the blast furnaces attached to associated steelworks, which require the hot metal, the bulk of the output is basic iron. Production of foundry iron is comparatively small, and could be sold many times over. Supplies to North-East Coast foundries are on a rationed basis, and deliveries to Scotland are much below former levels. There seems to be little prospect of conditions altering materially this year, and consumers will need to continue to draw supplies from whatever sources are available. Prices for Cleveland iron delivered Middlesbrough are:—No. 1 foundry grade, 103s. 6d.; No. 3 Cleveland G.M.B., 101s.; No. 4 foundry and No. 4 forge, 100s. per ton.

As in the case of foundry iron, there is little hematite left for the open market when the needs of the steelworks have been met. Contract deliveries are in arrears, and available supplies have to be carefully distributed to ensure equitable treatment of all consumers. High prices are obtainable for export, but only limited quantities can be released. Home prices are unchanged on the basis of 122s. 6d. delivered Middlesbrough for East-Coast mixed numbers, less 5s. rebate. Ore and coke still present problems to the hematite makers, which are not easy of solution.

LANCASHIRE.—Midland pig-iron makers supplying this area are sending forward good deliveries, and are doing all they can to ensure regular supplies. Nevertheless, there are complaints of belated and inadequate deliveries, and there is no doubt that a much bigger quantity could be sold were the iron available. Active conditions are reported from the light-castings foundries, and the jobbing foundries are also well placed for work. In addition a good tonnage of pig-iron is absorbed by machine-tool makers, electrical engineers, and textile machinists in Lancashire. For delivery to users in the Lancashire price zone, Staffordshire and Derbyshire brands of No. 3 foundry iron are on the basis of 109s., although there are still substantial quantities to be delivered at 89s. Northamptonshire No. 3 is quoted at 107s. 6d., and Derbyshire forge iron at 104s. to ironworks, and 106s. to foundries. Supplies of Scottish brands of iron, which are quoted at 136s., delivered equal to Manchester, are difficult to obtain. Hematite also is in short supply at the official quotations of 131s. for West-Coast and 130s. 6d. for East-Coast mixed numbers, less rebate.

MIDLANDS.—Deliveries of pig-iron in this area are rather more regular, but consumers still find it virtually impossible to obtain supplies over and above the tonnage absorbed in 1936, and increasing resort has to be made to other sources of supply. Continental high-phosphoric iron, similar to Northamptonshire iron in analysis, has been purchased at around £7 15s. per ton delivered in the Birmingham area. Some business has also been done in American low-phosphorus iron, for which recent prices have been about £7 17s. 6d. to £8 delivered. The tonnage involved has not been large, however. As will be seen, high prices have had to be paid for this foreign iron, comparing with controlled rates for ordinary No. 3 iron from home sources of 103s. 6d. for Northants No. 3 and 106s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, delivered Birmingham and Black Country stations. Ordinary forge pig is 5s. per ton below these levels when required for puddling, and 3s. below the No. 3 rates when taken by foundries.

Supplies of low-phosphorus iron for the engineering and motor trades, etc., are becoming scarce from home sources, very little coming on to the open market. Sales which have been made have been at a rather wide range of prices, depending on the rail haul involved and on the analysis of the iron, from £6 5s. to £7 5s. having been paid delivered this area, with about £8 per ton for refined iron. Hematite is no easier, supplies being limited. Minimum controlled prices are £6 14s. 6d. for West Coast mixed numbers and £6 13s. 6d. for East Coast No. 3, at station, with 1s. 6d. extra if delivered into works.

SCOTLAND.—Pig-iron of all grades is still in keen demand. Supplies for steelworks have been supplemented by arrivals from India, and some small shipments of foundry iron have been brought in from the Continent. Supplies of foundry grades, however, are still short and this is inclined to limit activity at the light-castings establishments and at foundries attached to engineering works, whose prospects otherwise are excellent. There is no change in prices, the official quotations being 115s. 6d. for No. 1 foundry and 113s. for No. 3, f.o.t. furnaces. No. 3 Cleveland is quoted at 104s. f.o.t. Falkirk and 107s. f.o.t. Glasgow. With regard to steelworks' supplies, 123s. is quoted for hematite mixed numbers, 107s. 6d. for British basic and 100s. for Indian basic, all delivered steelworks, and less 5s. rebate.

Coke

There is a continued strong demand for coke. Makers with associated ironworks have little of the furnace grades to spare for the market, while independent coking plants experience a bigger demand than they can satisfy readily. Similar conditions apply to foundry coke. There is a big export demand for all grades of coke, buyers abroad offering high prices in order to get supplies, and this is not without its repercussions on the home market. Bookings are usually confined to this year, although consumers would like to cover their requirements further ahead.

Steel

With the approach of the holiday season, the pressure by consumers upon the producing works to obtain delivery of steel is becoming accentuated. Comparatively few new transactions are reported, as most of the steelmakers are pursuing a cautious policy in view of the already heavy commitments upon their books. Only in exceptional cases is it possible to place orders for delivery before the last quarter of the year. In the semi-finished steel department, the producing works are making great efforts to meet consumers' requirements, but the production is much less than the market can absorb. As a consequence there is still a certain amount of irregular working in the consuming industries. Stringent conditions continue to rule in all departments of the finished steel market. The periods required for delivery appear to be expanding in spite of the almost record production by the British makers. There is a considerable amount of export inquiry, and as much attention as possible is being devoted to this side of the business in order to retain old connections in oversea markets.

Scrap

All classes of scrap remain in demand, but complaints of shortage are now less pronounced. Supplies of scrap steel from both home and foreign sources are being delivered more freely and the works are probably better placed than they have been for a long time. A position of plenitude has been by no means reached, however, and maximum prices under the supply scheme are easily obtainable for steelworks' supplies. Prices of cast-iron scrap still compare favourably with those of pig-iron, and this is in demand for foundries. On the North-East Coast heavy machinery cast-iron scrap is still obtainable at 90s., and ordinary heavy foundry cast iron at 85s., but these are minimum figures. Supplies of light cast iron are rather freely offered, and 72s. 6d. delivered works is the best figure obtainable. In the Midlands cast scrap is rather more plentiful, but prices are firm, 92s. 6d. being realised for heavy machinery and 87s. 6d. for good heavy metal.

Metals

Though trading conditions have again been quiet, there is more strength in the metal markets, and it is probable that they would quickly react to favourable influences. Prices have dropped considerably during the last few months, and this week have suffered a further setback as a result of the French financial crisis, but with steadier conditions an upturn in all metals would not be surprising.

Copper.—Consumers have come into the copper market again recently after holding off for some time and this renewal of interest has been reflected in the price position. Had this trade buying been in larger volume it is probable that prices would have jumped, as sentiment appears to be more favourable to the metal. There is nothing much wrong with the statistical position, and it may be noted that the market in the United States has been upheld in spite of the disturbing labour position there.

Metal Exchange quotations were as follow:—

Cash.—Thursday, £55 12s. 6d. to £55 15s.; Friday, £56 15s. to £56 17s. 6d.; Monday, £56 7s. 6d. to £56 10s.; Tuesday, £54 7s. 6d. to £54 10s.; Wednesday, £54 to £54 5s.

Three Months.—Thursday, £54 18s. 9d. to £55; Friday, £55 17s. 6d. to £56; Monday, £55 5s. to £55 7s. 6d.; Tuesday, £54 3s. 9d. to £54 6s. 3d.; Wednesday, £53 12s. 6d. to £53 17s. 6d.

Tin.—There is a better feeling in this market also. The mines are still in arrears with their quotas, and though it is assumed that with a percentage of 110 of the standard production established for the next three months they will make every effort to catch up, the fact that these arrears are considerable cannot be ignored. While prices show a profit on production lower levels are, of course, always possible, but at the present rate of consumption further retrogression seems hardly likely. It is more probable that prices will go higher.

Official quotations have been as follow:—

Cash.—Thursday, £249 15s. to £250; Friday, £256 to £256 5s.; Monday, £255 10s. to £255 15s.; Tuesday, £253 5s. to £253 15s.; Wednesday, £252 10s. to £253.

Three Months.—Thursday, £249 5s. to £249 15s.; Friday, £255 10s. to £255 15s.; Monday, £255 to £255 5s.; Tuesday, £253 to £253 5s.; Wednesday, £252 5s. to £252 15s.

Spelter.—The price of this metal has shown a tendency to increase, but another setback was recorded on Tuesday as a result of the French crisis, which affected all metals alike. The demand from consumers remains good and, with outside influences removed, further quiet improvement might fairly be anticipated.

Daily market prices:—

Ordinary.—Thursday, £21 2s. 6d.; Friday, £21 18s. 9d.; Monday, £22 10s.; Tuesday, £21 8s. 9d.; Wednesday, £21 13s. 9d.

Lead.—This metal also lost a little ground, in sympathy with other metals, when it became known that the franc was to be allowed to find its own level, but, this factor apart, rather firmer markets have been seen, and consumers and merchants have shown more interest. Building demand is less, but other industries appear to be making up the deficit, and prospects so far as consumption is concerned remain favourable.

Day-to-day quotations:—

Soft Foreign (Prompt).—Thursday, £23 1s. 3d.; Friday, £23 17s. 6d.; Monday, £23 18s. 9d.; Tuesday, £23 5s.; Wednesday, £23 8s. 9d.

Contracts Open

Marksbury, July 12.—2,230 yds. of 3-in. and 2-in. dia. cast-iron spun-iron water mains, for the Bathavon Rural District Council. Wilcox, Raikes & Marshall, engineers, 33, Great Charles Street, Birmingham. (Fee £5 5s., returnable.)

Johannesburg, July 26.—Two 10-ton self-propelling swing jib steam-driven travelling cranes, together with equipment and spares, for the South African Railways and Harbours Administration. The Deparment of Overseas Trade. (Reference T.Y. 24.342/37.)

Johannesburg, August 3.—3-ton, 5-ton and eight 10-ton capacity overhead electric travelling cranes, for the South African Railways and Harbours Administration. The Department of Overseas Trade. (Reference T.Y. 24,344/37.)

For **"easy stripping"** use

YORKSHIRE SAND

Yorkshire Sand is of a synthetic nature, its production being under careful laboratory control. Perfect standardization is obtained with the various grades, suitable for light and the heaviest steel castings.

It is because of the refractoriness of the sand and of the toughness of the mould surface that castings made with Yorkshire Sand are distinguishable by their excellent finish.

Please address all enquiries to the nearest Sales Office :

GENERAL REFRACTORIES LTD.,

Genefax House, Sheffield

Telephone : *Sheffield 31113 (6 lines).*

Telegrams : *"Genefax, Sheffield."*

LONDON OFFICE: Russell House, Adelphi, W.C.2.
Telephone: Temple Bar 7361. Telegrams: "Genefax, Rand-London." Mr. A. C. Turner.

SCOTTISH OFFICE: 48, West Regent Street, Glasgow. Telephone: 3009. Telegrams: "Genefax, Glasgow." (Mr. C. A. G. Thomson.)

MANCHESTER OFFICE: 9, Albert Square, Manchester, 2. Telephone: Blackfriars 6130. Telegrams: "Genefax, Manchester." (Mr. S. G. Throssell.)

SWANSEA OFFICE: Metropole Chambers, Wind Street, Swansea. Telephone: 3680. Telegrams: "Genefax, Swansea." (Mr. D. Hood-Williams.)

CARDIFF OFFICE: 17, Windsor Place, Cardiff. Telephone: 5796. Telegrams: "Genefax, Cardiff." (Mr. F. E. Rutter.)

MIDDLESBROUGH OFFICE: Halifax Buildings, Exchange Place.
Telephone: Middlesbrough 3313. Telegrams: "Genefax, Middlesbrough.

★

Read what an IMPORTANT STEELFOUNDER says :—

"During the 40 years I have been connected with Steel Foundry work, considerable changes have taken place. Away back, we had Steel Moulders' Composition, Old Crucible Pots, etc., and each works claimed to have its own 'secret' moulding composition. High Silica Sand has eliminated practically all these from many foundries and to-day we have your 'Yorkshire Sand' which acts almost like a chill, and leaves the skin of the casting blue-black and as clean as cast iron.

The hot steel lies quietly against the wall of sand, and often when the casting has been lifted out of the mould, the latter looks as if it could be used over again, just like a permanent mould."

RAW MATERIALS—PRICE LIST

(Wednesday, June 30, 1937)

COPPER

	£	s.	d.
Standard cash	54	0	0
Three months	53	12	6
Electrolytic	61	0	0
Tough	61	0	0
Best selected	61	15	0
Sheets	93	0	0
India	74	0	0
Wire bars	63	0	0
Ingot bars	63	0	0
H.C. wire rods	66	10	0
Off. av. cash, May	61	4	8 1/19
Do., 3 mths., May	58	6	4 7/38
Do., Sttlmnt., May	61	3	5 1/19
Do., Electro, May	64	13	5 1/19
Do., B.S., May	65	0	0
Do., wire bars, May	65	13	1 17/19
Solid drawn tubes			14½d.
Brazed tubes			14½d.
Wire			10¼d.

BRASS

Solid drawn tubes	12½d.
Brazed tubes	14½d.
Rods, drawn	11½d.
Rods, extd. or rlld.	7¾d.
Sheets to 10 w.g.	10½d.
Wire	9½d.
Rolled metal	9⅞d.
Yellow metal rods	7¾d.

TIN

	£	s.	d.
Standard cash	252	10	0
Three months	252	5	0
English	252	15	0
Bars	256	0	0
Straits	253	10	0
Eastern	253	0	0
Banca (nom.)	—		
Off. av. cash, May	250	16	11 13/18
Do., 3 mths., May	248	12	8 7/19
Do., Sttlmt., May	250	16	10 2/19

SPELTER

	£	s.	d.
Ordinary	21	13	9
Remelted	20	0	0
Hard	19	0	0
Electro, 99.9	24	5	0
English	22	15	0
India	19	10	0
Zinc dust	30	0	0
Zinc ashes	7	0	0
Off. aver., May	23	4	6 33/38
Aver. spot, May	23	1	10 3/19

LEAD

	£	s.	d.
Soft foreign, ppt.	23	8	9
Empire (nom.)	23	18	9
English	25	5	0
Off. aver., May	23	18	10 37/38
Aver. spot, May	24	0	0

ALUMINIUM

Ingots	£100 to £105
Wire	1/3 to 1/4 lb.
Sheet and foil	1/2 to 1/4 lb.

ZINC SHEETS, &c.

	£	s.	d.	£	s.	d.
Zinc sheets, English 36	0	0	to 36	10	0	
Do., V.M. ex-whse. 36	0	0	to 36	10	0	
Rods				29	0	0

ANTIMONY

	£	s.	d.	£	s.	d.
English	82	10	0 to	83	10	0
Chinese, ex-whse.				69	0	0
Crude, c.i.f.				35	10	0

QUICKSILVER

	£	s.	d.
Quicksilver	15	5	3

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—			
25%	14	0	0 (nom.)
45/50%	12	0	0 (nom.)
75%	17	0	0 (nom.)
Ferro-vanadium—			
35/50%			12/8 lb. Va
Ferro-molybdenum—			
70/75% carbon-free			4/9 lb. Mo.
Ferro-titanium—			
20/25% carbon-free			9d. lb.
Ferro-phosphorus, 20/25%			£21 to £22
Ferro-tungsten—			
80/85%			5/- lb. (nom.)
Tungsten metal powder—			
98/99%			5/1½ lb. (nom.)
Ferro-chrome—			
2/4% car.	34	15	0
4/6% car.	24	5	0
6/8% car.	24	0	0
8/10% car.	24	0	0
Ferro-chrome—			
Max. 2% car.	36	0	0
Max. 1% car.	38	5	0
Max. 0.5% car.	41	0	0
70% carbon-free			1/- lb.
Nickel—99.5/100%			£180 to £185
"F" nickel shot			£165 0 0
Ferro-cobalt, 98/99%			8/6 lb.
Metallic chromium—			
96/98%			2/5 lb.
Ferro-manganese—			
76/80% loose	£16	15	0 to 17 5 0
76/80% packed	£17	15	0 to 18 5 0
76/80% export			£20 0 0
Metallic manganese—			
94/96% carbon-free			1/3 lb.

Per ton unless otherwise stated, basis 2-ton lots.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 7d.
Finished bars, 18% tungsten	3s. 6d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ⅛ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 3/16 in.	1/- lb.
Flats, ⅛ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ⅛ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales (West)—	£	s.	d.	£	s.	d.
Heavy steel, best	3	7	6 to	3	10	0
Mixed iron and steel	3	5	0 to	3	7	6
Heavy cast iron	3	8	0 to	3	10	0
Good machinery				4	0	0
Cleveland—						
Heavy steel, best	3	6	6 to	3	9	0
Steel turnings				2	15	0
Heavy cast iron				4	5	0
Heavy machinery				4	10	0
Midlands—						
Short heavy steel	3	15	0 to	4	0	0
Light cast-iron scrap				3	5	0
Heavy wrought iron	4	0	0 to	4	5	0
Steel turnings	2	2	6 to	2	5	0
Scotland—						
Heavy steel, best	3	4	6 to	3	7	0
Ordinary cast iron				4	7	6
Cast-iron borings	2	0	0 to	2	2	6
Wrot-iron piling				4	12	6
Heavy machinery				4	12	6

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	48	0	0
Brass	31	10	0
Lead (less usual draft)	20	0	0
Tea lead	14	0	0
Zinc	14	0	0
New aluminium cuttings	74	0	0
Braziery copper	42	0	0
Gunmetal	45	10	0
Hollow pewter	160	0	0
Shaved black pewter	115	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	103/6
„ No. 3	101/-
„ No. 4	100/-
Forge No. 4	100/-
Hematite No. 1	123/-*
Hematite M/Nos.	122/6*
N.W. Coast—	
Hem. M/Nos. d/d Glas.	123/-*
„ d/d Birm.	134/6*
Malleable iron d/d Birm.	160/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	103/-
„ No. 3 fdry.	106/-
Northants forge	100/6
„ fdry. No. 3	103/6
„ fdry. No. 1	106/6
Derbyshire forge	103/-
„ fdry. No. 3	106/-
„ fdry. No. 1	109/-
Scotland—	
Foundry, No. 1, f.o.t.	115/6
„ No. 3, f.o.t.	113/-
Cleveland No. 3, Glasgow	107/-
„ „ Falkirk	104/-
Scottish hem. M/Nos. d/d	123/-*
Sheffield (d/d district)—	
Derby forge	100/6
„ fdry. No. 3	103/6
Lincs forge	100/6
„ fdry. No. 3	103/6
W.C. hematite	128/6*
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	109/-
Staffs fdry. No. 3	109/-
Northants fdry. No. 3	107/6
Cleveland fdry. No. 3	109/-
Glengarnock, No. 3	136/-
Clyde, No. 3	136/-
Monkland, No. 3	136/-
Summerlee, No. 3	136/-
Eglinton, No. 3	136/-
Gartsherrie, No. 3	136/-
Shotts, No. 3	136/-

* Subject to a rebate of 5s. per ton under certain conditions.

FINISHED IRON AND STEEL

Usual district deliveries.

[A rebate of 15/- per ton for steel sections, plates and joists is obtainable in the home trade under certain conditions.]

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)				11	17	6
Nut and bolt iron	10	5	0 to	10	15	0
Hoops				12	15	0
Marked bars (Staffs) f.o.t.				14	7	6
Gas strip				12	15	0
Bolts and nuts, ¾ in. × 4 in.				17	10	0 and up.
Steel—						
Plates, ship, etc.	11	8	0 to	11	10	6
Boiler plts.	11	18	0 to	12	0	6
Chequer plts.				13	0	6
Angles				11	0	6
Tees				12	0	6
Joists				11	0	6
Rounds and squares, 3 in. to 5½ in.				12	0	6
Rounds under 3 in. to ⅜ in. (Untested)				11	9	0
Flats—8 in. wide and over				11	5	6
„ under 8 in. and over 5 in.				11	10	6
Rails, heavy				10	2	6
Fishplates				14	2	6
Hoops (Staffs)				12	4	0
Black sheets, 24g. (4-t. lots)				15	15	0
Galv. cor. shts. („)				19	10	0
Galv. flat shts. („)				20	0	0
Galv. fencing wire, 8g. plain				20	5	0
Billets, soft, 100-ton lots				7	17	6
Sheet bars				7	15	0
Tin bars				7	15	0

PHOSPHOR BRONZE

	Per lb. basis
Strip	13d.
Sheet to 10 w.g.	13½d.
Wire	14⅞d.
Rods	15½d.
Tubes	20½d.
Castings	16d.

Delivery 3 cwt. free.
10% phos. cop. £33 above B.S.
15% phos. cop £38 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
to 10g.	1/6½ to 2/1½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/5½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	25.76
No. 2 foundry, Valley	24.00
No. 2 foundry, Birm.	20.38
Basic, Valley	23.50
Malleable, Valley	24.00
Grey forge, Valley	23.50
Ferro-mang. 80%, seaboard	102.50
O.-h. rails, h'y, at mill	42.50
Billets	37.00
Sheet bars	37.00
Wire rods	47.00
	Cents.
Iron bars, Chicago	2.40
Steel bars	2.45
Tank plates	2.25
Beams, etc.	2.25
Skelp, grooved steel	2.10
Steel hoops	2.40
Sheets, black, No. 24	3.15
Sheets, galv., No. 24	3.80
Wire nails	2.75
Plain wire	2.90
Barbed wire, galv.	3.40
Tinplates, 100-lb box	$5.35

COKE (at ovens)

Welsh foundry	42/6
„ furnace	36/-
Durham foundry	38/6
„ furnace	36/6
Scotland foundry	35/-
„ furnace	37/6

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	25/- to 26/-
„	28×20 „	50/- to 52/-
„	20×10 „	35/- to 36/-
„	18¾×14 „	25/3 to 26/3
C.W.	20×14 „	22/- to 23/-
„	28×20 „	45/- to 46/6
„	20×10 „	31/3 to 32/6
„	18¾×14 „	23/3 to 25/3

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.	£	s.	d.
Pig-iron	£12	0	0 to	£13	0	0
Bars-hammered, basis	£20	0	0 to	£21	0	0
Bars and nail-rods, rolled, basis	£19	0	0 to	£20	0	0
Blooms	£16	0	0 to	£17	0	0
Keg steel	£27	0	0 to	£30	0	0
Faggot steel	£20	0	0 to	£25	0	0
Bars and rods dead soft st'l	£19	0	0 to	£20	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 19.39 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£ s. d.	
June	24 ..	55 12 6	inc. 5/-
,,	25 ..	56 15 0	,, 22/6
,,	28 ..	56 7 6	dec. 7/6
,,	29 ..	54 7 6	,, 40/-
,,	30 ..	54 0 0	,, 7/6

Electrolytic Copper

		£ s. d.	
June	24 ..	62 0 0	inc. 20/-
,,	25 ..	62 10 0	,, 10/-
,,	28 ..	62 10 0	No change
,,	29 ..	61 0 0	dec. 30/-
,,	30 ..	61 0 0	No change

Standard Tin (cash)

		£ s. d.	
June	24 ..	249 15 0	inc. 40/-
,,	25 ..	256 0 0	,, 125/-
,,	28 ..	255 10 0	dec. 10/-
,,	29 ..	253 5 0	,, 45/-
,,	30 ..	252 10 0	,, 15/-

Tin (English ingots)

		£ s. d.	
June	24 ..	250 0 0	inc. 45/-
,,	25 ..	256 0 0	,, 120/-
,,	28 ..	255 15 0	dec. 5/-
,,	29 ..	253 10 0	,, 45/-
,,	30 ..	252 15 0	,, 15/-

Spelter (ordinary)

		£ s. d.	
June	24 ..	21 2 6	inc. 2/6
,,	25 ..	21 18 9	,, 16/3
,,	28 ..	22 10 0	,, 11/3
,,	29 ..	21 8 9	dec. 21/3
,,	30 ..	21 13 9	inc. 5/-

Spelter (Electro, 99.9 per cent.)

		£ s. d.	
June	24 ..	23 13 9	inc. 3/9
,,	25	24 10 0	,, 16/3
,,	28 ..	25 0 0	,, 10/-
,,	29 ..	24 0 0	dec. 20/-
,,	30 ..	24 5 0	inc. 5/-

Lead (soft foreign, prompt)

		£ s. d.	
June	24 ..	23 1 3	inc. 2/6
,,	25 ..	23 17 6	,, 16/3
,,	28 ..	23 18 9	,, 1/3
,,	29 ..	23 5 0	dec. 13/9
,,	30 ..	23 8 9	inc. 3/9

Lead (English)

		£ s. d.	
June	24 ..	25 0 0	inc. 5/-
,,	25 ..	25 15 0	,, 15/-
,,	28 ..	26 0 0	,, 5/-
,,	29 ..	25 5 0	dec. 15/-
,,	30 ..	25 5 0	No change

A COMPARISON OF SCRAP PRICES

Prices of Heavy Steel Scrap (Delivered) in the Principal Districts at the Beginning of Each Month in the Years 1930–1937.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Scotland—													
1930	3 9 0	3 7 6	3 5 0	3 5 0	3 0 6	2 15 0	2 12 0	2 10 0	2 13 3	2 10 0	2 10 0	3 10 6	3 13 1½
1931	2 7 6	2 7 6	2 5 0	2 5 0	2 0 0	1 17 6	1 17 6	1 17 6	1 17 6	1 15 0	2 0 0	2 10 0	2 17 3½
1932	2 2 6	2 2 6	2 0 0	1 17 6	1 17 6	1 17 6	1 15 0	1 15 0	1 12 6	1 13 0	1 12 6	2 2 6	2 1 0½
1933	1 15 0	1 17 6	1 18 6	1 18 9	1 18 0	1 17 6	1 18 9	2 0 0	2 3 6	2 5 0	2 7 6	1 15 0	1 16 9½
1934	2 8 9	2 14 3	2 13 0	2 13 0	2 12 0	2 10 0	2 10 6	2 10 6	2 11 0	2 10 9	2 10 0	2 8 9	2 0 7½
1935	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 11 2
1936	2 12 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 1
1937	2 17 6	3 0 0	3 5 0	3 4 6	3 4 6	3 4 6	—	—	—	—	—	—	—
North-East Coast—													
1930	3 3 6	3 3 6	3 2 0	3 0 0	2 17 6	2 10 0	2 10 0	2 7 6	2 7 6	2 7 6	2 5 0	2 6 0	2 13 4
1931	2 6 0	2 6 0	2 5 0	2 5 0	2 2 6	2 0 0	1 17 6	1 17 6	1 17 6	1 17 6	1 17 6	2 2 6	2 1 2½
1932	2 0 0	2 0 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 12 6	1 15 0	1 17 6	1 15 10
1933	2 0 0	2 0 0	2 5 0	2 0 0	1 15 0	1 17 6	2 2 6	2 2 6	2 3 6	2 5 0	2 7 6	2 7 6	2 2 2
1934	2 10 0	2 16 0	2 10 0	2 7 6	2 7 6	2 10 0	2 9 9	2 10 0	2 10 0	2 10 0	2 11 6	2 11 3	2 10 3½
1935	2 11 6	2 11 9	2 12 0	2 12 0	2 12 6	2 12 6	2 12 6	2 12 6	2 12 6	2 12 6	2 12 6	2 13 9	2 12 4½
1936	2 15 0	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	3 0 0	3 0 0	2 17 8½
1937	3 2 6	3 5 0	3 7 0	3 7 0	3 7 0	3 6 6	—	—	—	—	—	—	—
South Wales—													
1930	3 7 6	3 6 0	3 6 0	3 4 0	3 2 6	2 17 6	2 16 0	2 15 0	2 14 9	2 12 6	2 12 6	2 5 0	2 18 3½
1931	2 5 0	2 7 6	2 7 6	2 7 6	2 5 0	2 2 6	2 0 0	2 0 0	1 18 0	2 2 6	2 5 0	2 7 6	2 4 0
1932	2 6 6	2 6 0	2 5 0	2 2 6	2 2 0	1 19 0	1 17 6	1 18 6	1 18 0	1 18 0	1 17 6	1 18 0	2 0 8½
1933	2 0 0	2 1 6	2 4 0	2 3 6	2 3 0	2 3 0	2 5 0	2 5 0	2 8 0	2 10 0	2 10 0	2 10 0	2 5 3½
1934	2 10 0	2 16 3	2 15 9	2 13 9	2 14 3	2 15 0	2 14 3	2 14 3	2 15 0	2 15 6	2 15 6	2 15 6	2 14 7
1935	2 15 6	2 15 6	2 15 6	2 15 6	2 15 6	2 15 6	2 15 6	2 16 1½	2 17 9	2 19 8	3 1 1½	2 16 2½
1936	3 2 6	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 3 0	3 2 0	3 2 0	3 4 0	3 4 0	3 3 10½
1937	3 5 0	3 10 0	3 10 0	3 8 0	3 8 0	3 7 6	—	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG IRON
REGISTERED TRADE MARK
LIMPET

FOR EVERY TYPE OF CASTING

NON-FERROUS METALS

REFRACTORIES — COKE — SAND
FERRO-SILICON—FERRO-CHROME

WILLIAM JACKS & COMPANY,
CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.
ZETLAND ROAD, MIDDLESBROUGH.

SITUATIONS VACANT AND WANTED

A YOUNG Foundry Engineer, age 25, with unique experience, both practical and theoretical, would like opportunity of giving particulars of his experience and training to any firm likely to require such services.—Box 464, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

BRASSFOUNDRY, North London. Assistant Foreman wanted. Experience in oddside, plate moulding, coremaking. Permanent post for smart man age 30-35. Salary, etc.—Box 468, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ROLL CASTER, wide experience in manufacture of chilled plate rolls, hot and cold sheet and tin mill rolls, grain rolls, etc., requires position. Fully conversant with tackle required. Capable of taking complete charge.—Box 444, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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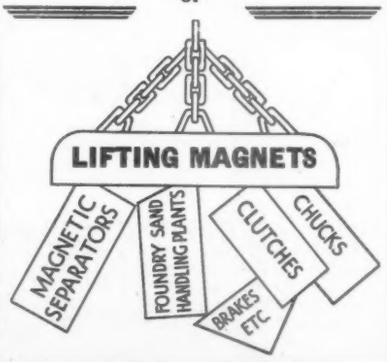
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